

December 2014

Residential Cluster Development in West Boylston

Briana Stashik Weisgerber
Worcester Polytechnic Institute

Christopher Steven Long
Worcester Polytechnic Institute

Melissa Barbara Landi
Worcester Polytechnic Institute

Follow this and additional works at: <https://digitalcommons.wpi.edu/mqp-all>

Repository Citation

Weisgerber, B. S., Long, C. S., & Landi, M. B. (2014). *Residential Cluster Development in West Boylston*. Retrieved from <https://digitalcommons.wpi.edu/mqp-all/3038>

This Unrestricted is brought to you for free and open access by the Major Qualifying Projects at Digital WPI. It has been accepted for inclusion in Major Qualifying Projects (All Years) by an authorized administrator of Digital WPI. For more information, please contact digitalwpi@wpi.edu.

RESIDENTIAL CLUSTER DEVELOPMENT IN WEST BOYLSTON, MA

A Major Qualifying Project Proposal

Submitted to the Faculty

of

WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

in Civil Engineering

by

Melissa Landi

Christopher Long

Briana Weisgerber

December 14, 2014

Abstract

The Town of West Boylston, Massachusetts implemented residential cluster development (RCD) subdivision bylaws to address local housing challenges. The project team utilized this bylaw to create site designs on a town-owned property in West Boylston. The team conducted a site analysis that included delineating wetlands, reviewing ArcGIS data, and consulting local agencies. The team then created traditional and RCD designs in AutoCAD Civil 3D. The team evaluated these designs and developed recommendations for the Town of West Boylston's subdivision process.

Authorship

SECTION		AUTHOR(S)
Abstract		Weisgerber
Acknowledgements		Weisgerber
Capstone Design Statement		Weisgerber
Introduction		Landi
Background		
	West Boylston	Landi
	Residential Cluster Development	Weisgerber
	RCD Plan Development	Long
Methods		
	Interviews	Long
	Site Plan Development	All
	Review with Local Agencies	Weisgerber
	Cost Estimation	Landi
Results		
	Interviews	Weisgerber
	Site Plan Development	Long
	Review with Local Agencies	Landi
	Cost Estimation	Landi
Recommendations		
	Require an RCD Preliminary Plan for all Subdivisions	Long
	Raise Awareness	Long
	RCD Specifications for Multi-Family housing	Long
Site Plan Design		All

All members of the team reviewed and edited all portions of this report. All members contributed to the site design, however Melissa Landi and Briana Weisgerber took the lead in the use of AutoCAD Civil 3D. Chris Long took the lead on the awareness pamphlet and visual aids.

Acknowledgements

This project would not have been possible without the time and effort of many people and the support of WPI. We would like to thank the following people:

Professor Suzanne LePage for advising our project.

Vincent Vignaly from the West Boylston Planning Board for sponsoring our project and supporting us with Department of Conservation and Recreation contact along the way.

The members of the West Boylston Planning Board for recommending the use of the Mixer parcel and reviewing our preliminary design drawings.

The members of the West Boylston Conservation Commission, especially David Eckhardt, for taking the time to help us understand conservation restrictions within West Boylston.

Leon Gaumond, West Boylston Town Administrator, for taking the time to explain to us the current needs of the Town.

The West Boylston Water District for supplying us with information regarding water accessibility at the Mixer parcel.

Anthony Silvia from the Public Works Department for supplying us with information regarding the sewer capacity at the Mixer parcel.

Paul McManus from EcoTec, Inc. for taking the time to teach us about delineating wetlands on the Mixer parcel.

Jeff Perkins for providing us with information regarding development in West Boylston.

Executive Summary

West Boylston, a rural town in central Massachusetts, currently faces challenges encouraging developers to utilize residential cluster development (RCD). Residential cluster development, also known as open space development, is a form of housing development with smaller minimum lot acreage requirements than traditional subdivisions to allow for preservation of open space. RCD is one method to address the Town of West Boylston's 2005 Master Plan goals. These goals are centered around diversifying housing options in the town for different lifestyles and incomes and preserving natural open space ("Master Plan of the Town of West Boylston," 2005).

Methodology

For this project, the team utilized input from local town officials and developers to analyze the current challenges of the town and how these challenges could be impacted by RCD. A member of the Planning Board, Vincent Vignaly, sponsored the project and acted as a resource for the team when consulting town officials. Per recommendation of the Planning Board, the team chose to create a preliminary RCD subdivision design on the town-owned Mixer parcel at 120 Prescott Street. This design included a traditional and RCD design to allow the team to conduct comparisons of the different methods and present the results to the Town. The team identified the following two main objectives:

- Identify challenges restricting the use of RCD in West Boylston.
- Identify methods to attract the use of RCD in West Boylston.

The team first conducted interviews with local developers to understand a developer's perspective on the benefits and challenges of RCD. The interviews also helped the team better

understand benefits and challenges to traditional development in West Boylston. The team then conducted interviews with the local Town Administrator and members of the Conservation Commission to better understand the Town's perspective on development and the current needs of the Town.

The second step in the process was analyzing the selected Mixer parcel. The team conducted a site analysis that included a site walk, GIS data, a wetlands analysis, and an analysis of the local utilities. The site walk and GIS data allowed the team to better understand the overall characteristics of the site. Per the recommendation of the Conservation Commission, the team contacted a wetlands specialist to help the team delineate bordering vegetated wetlands per the Massachusetts Wetlands Protection Act definition. The team also contacted the West Boylston Water District and the Department of Public Works to determine the feasibility of accessing sewer and municipal water on the site.

Following the site analysis process, the team used AutoCAD Civil3D to design three proposed site plans for the property. The team first designed a traditional subdivision in conformance with West Boylston's traditional subdivision bylaws which requires no open space and a minimum lot size of 40,000 square feet. This step was necessary to determine the maximum number of lots which could fit on the parcel, which was 10. The team then followed West Boylston's RCD bylaws to create a second subdivision design with 10 lots having a minimum lot size of only 5,000 square feet. Lastly, the team created a third design by incorporating 5 duplex units in a very similar RCD subdivision. The duplex design was more suited to meet the goals of the Master Plan.

Results and Recommendations

While designing these subdivisions, the team considered many criteria such as minimizing environmental impact, minimizing cost, easing constructability, improving standard of living, and maximizing recreational town use of the property. Upon completing the designs, comparisons showed that RCD design standards made it more flexible in terms of constructability, creativity of design, and environmental impact. This nature of design created many opportunities to benefit the town, residents, and the developer. RCD standards also allowed the design to work around many of the limitations and restrictions on the site. Through the site design process the team developed the following three recommendations to the Town of West Boylston:

1. Require an RCD preliminary plan for all subdivisions.
2. Raise awareness of RCD among developers and residents in West Boylston.
3. Create specifications for RCD multifamily housing.
4. If the Town were to develop the Mixter parcel, they use a duplex or multifamily RCD design.

Capstone Design Statement

This Major Qualifying Project consisted of three preliminary subdivision designs for the Town of West Boylston. During this design process, the team held themselves to certain design methods and standards established by the Town of West Boylston and the State of Massachusetts. The following constraints were addressed during the completion of this project: economic, environmental, health and safety, social, and constructability.

Economic: The team compared the construction costs of a residential cluster development (RCD) to a traditionally designed subdivision. The cost analysis was done on the traditional and RCD designs on 120 Prescott Street. The lower construction costs of RCD are beneficial for developers and thus may be more appealing. The Town of West Boylston also desires low cost housing to allow for age diversification of its residents. The lower cost housing appeals to diverse age populations such as recent college graduates or residents over fifty five.

Environmental Sustainability: Environmental sustainability played a large part in the design of this project. One of the main goals of residential cluster development is to conserve open space. When creating both site plans the team considered other environmental factors including low impact development and stormwater management. The Department of Conservation and Recreation also has a large impact in West Boylston as it is mandated to protect the water quality of the Wachusett Reservoir. This reservoir provides drinking water supply for 2.2 million people in the Metropolitan Boston area (Massachusetts, 2014b). The sensitivities in the area increased the importance of effective stormwater management. Stormwater drainage was a large consideration during the project while designing the road and grading.

Constructability: To consider constructability, the team assessed the pre-existing infrastructure on the site. They designed the subdivision around existing infrastructure and accounted for the costs of additional infrastructure. The team also considered the amount of grading and effects of physical features when designing the subdivision. The team estimated the size of the proposed houses and garages for each design based on surrounding housing and the average size of a single family home.

Ethical: For the design work, the group followed the West Boylston subdivision regulations and provided realistic recommendations for RCD. Throughout this project, the team aimed to provide the best possible solutions for each party affected. The team also followed the ASCE code of ethics while conducting this project.

Health & Safety: The team addressed health and safety by complying with town regulations, which aim to promote and maintain the health and safety of the population. The team also created a healthy living environment by preserving open space in a residential community. One constraint that was considered during the design process was the desire for public use of the parking and recreational space. The team followed design standards to allow for an adequate amount of properly sized parking spaces and traffic circulation in the parking lot. This process of design may have incurred higher construction costs, yet it was more important to maintain the health and safety of the community.

Social Political: One social and political constraint on this project was working with elected Town employees and officials from Planning Board. The project aimed to meet the needs of the West Boylston as defined by the Housing Production Plan, Master Plan, and local town officials. The RCD design allowed for the team to address many of the town's needs. For example, the flexible nature of an RCD design allowed the team to place two full size soccer fields and a

playground area on the property in a neighborhood that currently has a shortage of recreational spaces.

Table of Contents

Title Page	i
Abstract.....	i
Authorship	ii
Acknowledgements.....	iii
Executive Summary	iv
Capstone Design Statement.....	vii
Table of Contents	x
Table of Figures	xiii
Table of Tables	14
1 Introduction.....	15
2 Background	17
2.1 West Boylston	17
2.1.1 Department of Conservation and Recreation.....	20
2.2 Residential Cluster Development	20
2.2.1 Massachusetts.....	20
2.2.2 West Boylston.....	22
2.3 RCD Plan Development	24
3 Methods	26
3.1 Interviews	26
3.1.1 Interviews Pertaining to West Boylston.....	27
3.1.2 Interviews Pertaining to Site Design	27

3.2 Site Plan Development	28
3.2.2 Site Analysis	28
3.2.3 Site Design	31
3.3 Review with Local Agencies	36
3.4 Cost Estimation.....	36
4 Results	37
4.1 Interviews	37
4.2 Site Plan Development	39
4.2.1 Site Analysis	39
4.2.2 Site Design	49
4.3 Review with Local Agencies	63
4.4 Cost Estimation.....	64
5 Recommendations	66
5.1 Require an RCD Preliminary Plan for all Subdivisions.....	66
5.2 Raise Awareness	67
5.3 RCD Specifications for Multifamily Housing	67
5.4 Develop Multifamily Housing on the Mixer Parcel	68
Appendix A: Proposal.....	69
Appendix B: Interview Protocols and Results	97
David Eckhardt Site Walk	97
Interview with Jeff Perkins	98
Interview with Developer from Over 55 Development	100
Interview with Leon Gaumond	101

Appendix C: Stormwater Calculations	104
Appendix D: Daily Site Plan Development Log	106
Appendix E: List of Abutters	112
Appendix F: Awareness Tool	116
Works Cited	119

Table of Figures

Figure 1: Layout of project from goal through final deliverables.	16
Figure 2: Zoning map for the Town of West Boylston.....	19
Figure 3: Massachusetts Smart Growth Toolkit visual comparison of conventional subdivision to open space residential development.	21
Figure 4: Image of the east side of the property from team site visit to Mixter parcel....	40
Figure 5: Image of property from team site visit to Mixter parcel.	41
Figure 6: Fire hydrant on Mixter property from team site visit.	42
Figure 7: Map of Mixter parcel showing path to Horseshoe Drive.	43
Figure 8: Walking path on east side of property connecting to Horseshoe Drive.	43
Figure 9: Town GIS image showing features of Mixter parcel.	44
Figure 10: Web soil survey data for Mixter property.	46
Figure 11: Team wetlands analysis using soil samples.	47
Figure 12: West Boylston Water Department Hydrant Flow Data Summary.	49
Figure 13: Watershed divisions for the RCD single family conditions. Numbering corresponds with Table 4.	62
Figure 14: Drainage area divisions for the existing conditions. Numbering corresponds with Table 4.	62

Table of Tables

Table 1: Rational method equation.	32
Table 2: West Boylston Zoning Bylaw 4.2 Schedule of Dimensional Requirements.	34
Table 3: Site design results comparison.....	50
Table 4: Results of stormwater peak discharge calculations.....	61
Table 5: Earthwork and Pavement Cost Estimation for Traditional Site Plan	65
Table 6: Earthwork and Pavement Cost Estimation for RCD Site Plan	65

1 Introduction

West Boylston, a rural town in central Massachusetts, currently faces challenges encouraging developers to utilize residential cluster development (RCD). Residential cluster development, also known as open space development, is a form of subdivision development with smaller minimum lot acreage requirements than traditional subdivisions to allow for preservation of open space. RCD is one method to address the Town of West Boylston's 2005 Master Plan goals. These goals are centered around diversifying housing options in the town for different lifestyles and incomes and preserving natural open space ("Master Plan of the Town of West Boylston," 2005). The more recent Housing Production Plan sites RCD as a possible method for encouraging affordable housing, a main focus of the town to reach state standards (West Boylston, 2013). The Planning Board believes that RCD could help achieve these goals, however a developer has yet to propose an RCD in West Boylston.

The goal of this project was to review the bylaw and propose recommendations for the Town of West Boylston to help encourage RCD in the community. To accomplish this goal the main objectives are as follows:

- Identify challenges restricting the use of RCD in West Boylston.
- Identify methods to encourage the use of RCD in West Boylston.

Specific methods were identified for each objective, which included conducting interviews with local developers and designing a preliminary subdivision plan according to West Boylston Zoning Bylaw 3.11.E (see Figure 1). Through these processes the team developed a site plan comparison and promotional materials to help the Planning Board and the Town of West Boylston encourage RCD in the community.

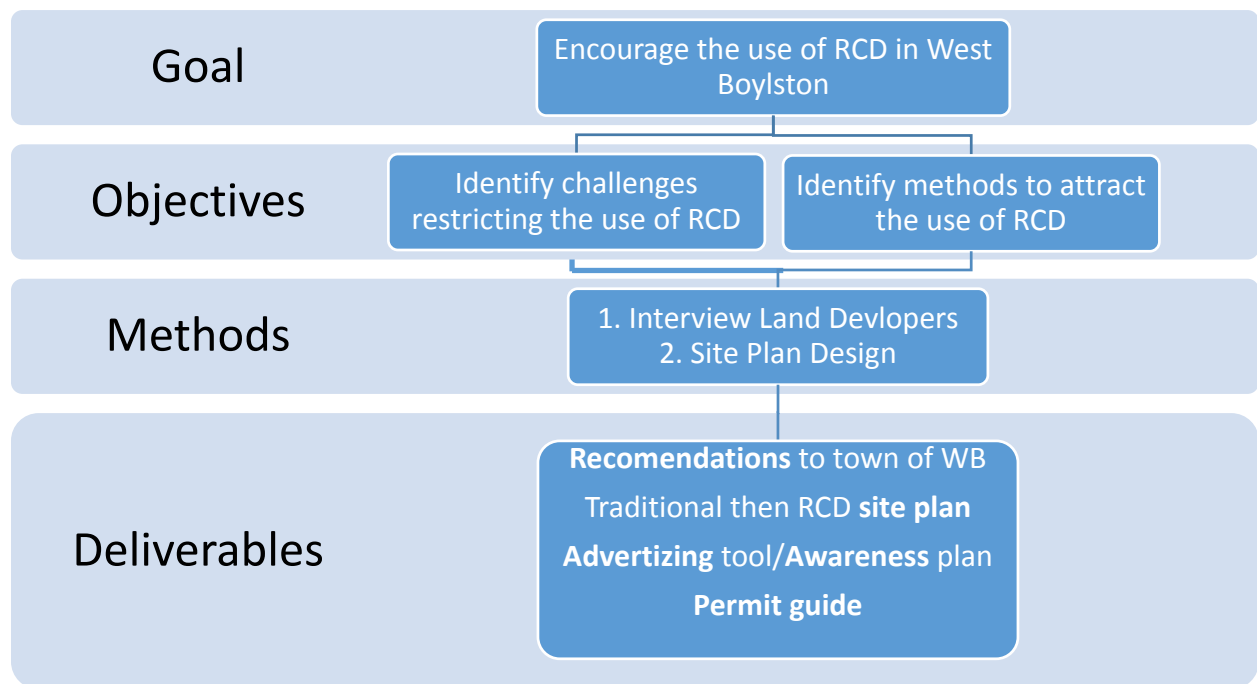


Figure 1: Layout of project from goal through final deliverables.

2 Background

The Town of West Boylston faces challenges as it plans for its desired residential growth while also meeting Massachusetts Chapter 40B regulations. This section explains the current housing challenges in the town. It also contains examples of others towns in Massachusetts similar to West Boylston with successful RCD by-laws as well as RCD recommendations from the state of Massachusetts. In addition, this background addresses the process of site plan development.

2.1 West Boylston

West Boylston is a charming rural New England town in central Massachusetts. The current population of West Boylston, per the 2010 Census, is 7,669 with 1,138 of those residing in the Worcester County House of Corrections (T. o. W. Boylston, 2008; West Boylston, 2013). In addition, the Department of Conservation and Recreation owns about 40 percent of the land in the town and restricts development 400 feet of a stream to protect the water quality of the Wachusett Reservoir.

The majority of the town is zoned for single-family residences, as can be seen in Figure 2 (T. o. W. Boylston, 2008). The remaining space is zoned for business, commercial and industrial use. Until recently, much of the Town's development was governed by Massachusetts Chapter 40B. This law prohibited the Zoning Board of Appeals from denying a proposed 40B project because the Town did not have the 10 percent affordable housing per state requirements. Recently, the Town believes it has achieved the alternative requirement that 1.5 percent of the land area in the town has affordable housing and allows the Town to deny a 40B development application that it believes is not desirable.

As stated in the Housing Production Plan, "West Boylston desires to provide housing options for

a diverse range of households while preserving its vision of a community rural in character.” Between 2000 and 2010, the community had a large increase in the population ages 45 and over due to two large over-55 housing developments and, simultaneously, had a decrease in the population ages 44 and under. The Plan points to a lack of affordable rental housing as a possible reason for the decrease in residents ages 25 through 44 as this population tends to be more mobile. For this reason, the Town believes it needs more affordable rental housing with two to three bedrooms to accommodate the younger population. Also according to the Plan, 35 percent of residents renting homes in West Boylston are considered “housing cost burdened” because they spend 30 percent or more of their household’s income on housing expenses. The Town believes this shows a need for subsidized rental properties in the community to reduce the population who are “housing cost burdened.”

One way the Town would like to address this need is to provide subsidized housing for at least 50 percent of the units constructed on Town-owned parcels. The Town has identified certain Town-owned properties with potential for housing development including a property at 120 Prescott Street. The Town also has stated more first floor and adaptive subsidized units need to be developed to accommodate the aging and disabled population of the town.

The Town of West Boylston recently adopted a RCD by-law that allows for clustered development of housing to maintain open space for conservation. This bylaw could allow for more affordable homes to be constructed on small plots of land while still preserving open space. The Housing Production Plan states the Planning Board should encourage RCD as an alternative when a preliminary subdivision plan is submitted, however, the bylaw has yet to be attempted in the town of West Boylston (*Chapter 40B Land Area Minimum*; West Boylston, 2013).

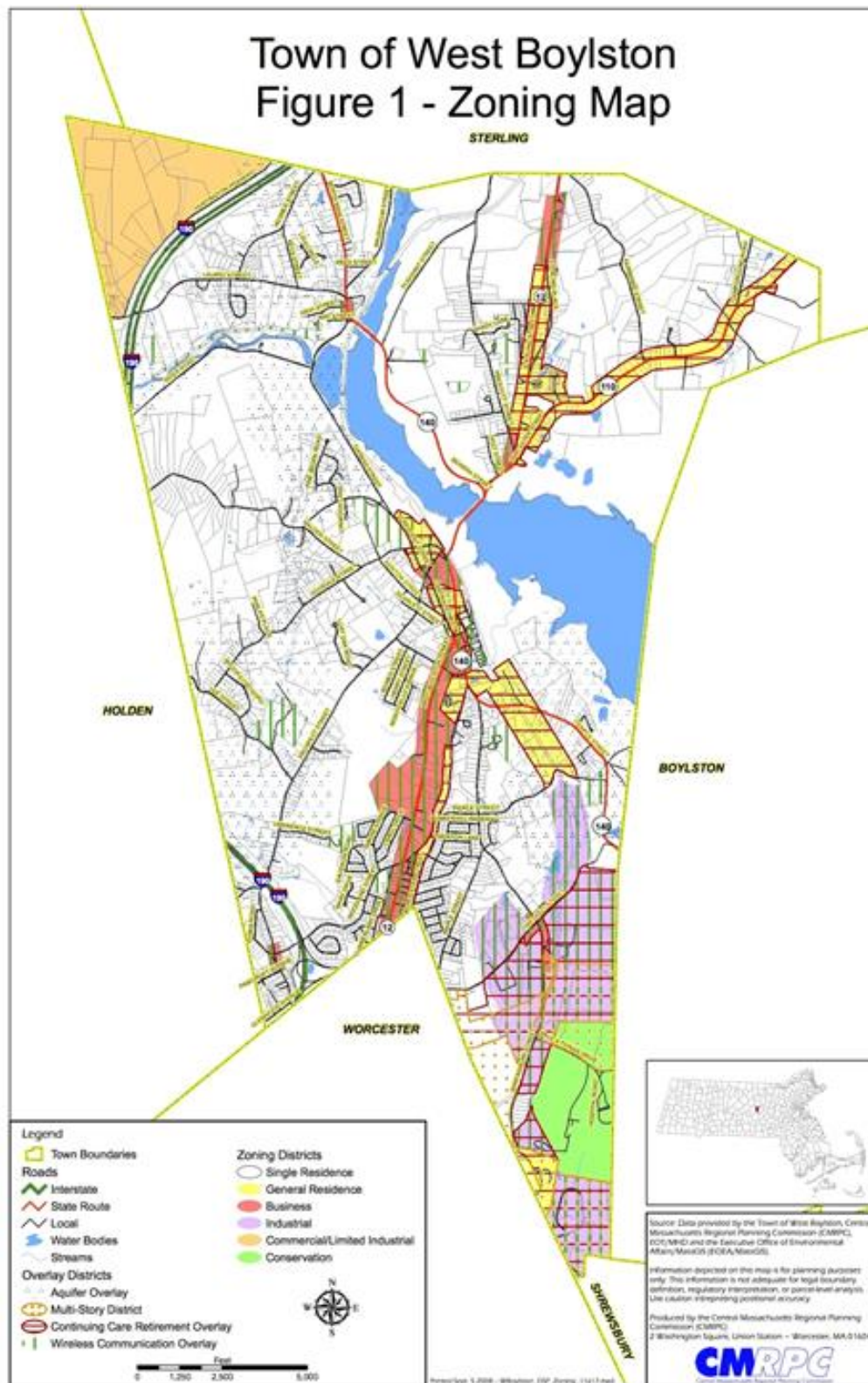


Figure 2: Zoning map for the Town of West Boylston.

2.1.1 Department of Conservation and Recreation

The Department of Conservation and Recreation (DCR) Division of Water Supply Protection is a Massachusetts state agency dedicated to protecting, managing, and enhancing the water quality within the Wachusett Reservoir (Massachusetts, 2014a). The reservoir was built from 1895 to 1905 to provide drinking water to Boston and the surrounding areas. This reservoir provides drinking water for 2.2 million people in the Metropolitan Boston region. To protect the sensitive areas of the watershed, the DCR purchases property in fee or buys development rights to property within the watershed (D. Massachusetts, 2012). When the DCR purchases the development rights to land, at about 80% of the full value of the land, it restricts development on that land. DCR ownership restricts development on approximately 38% of the land area of West Boylston (West Boylston, 2013). DCR land ownership does have financial benefits for the town, however. In Fiscal Year 2014, the town of West Boylston was paid \$642,130 in Payment-In-Lieu-Of-Tax fees for the DCR owned property (Massachusetts, 2014c)

2.2 Residential Cluster Development

2.2.1 Massachusetts

Open space development is also known as open space residential development or residential cluster development (RCD). An RCD is defined as a subdivision development with smaller minimum lot acreage and road frontage requirements than traditional subdivisions to allow for preservation of open space. This method is intended to protect existing agricultural land, wetlands, or desirable landscape areas. RCD protects conservation areas and minimizes impervious cover on the land while also creating a development that fits the existing character of

the town. An example of RCD can be seen in Figure 3. A traditional development may subdivide a parcel into eight one-acre lots. In contrast, an RCD might subdivide the parcel into eight-quarter acre lots and would leave six acres of communal open space. This method allows for conservation of protected land and requires less construction of infrastructure for the developer. The open space can be used as a buffer between the development and neighboring houses as well as land for trails, gardens, parks, and fields.

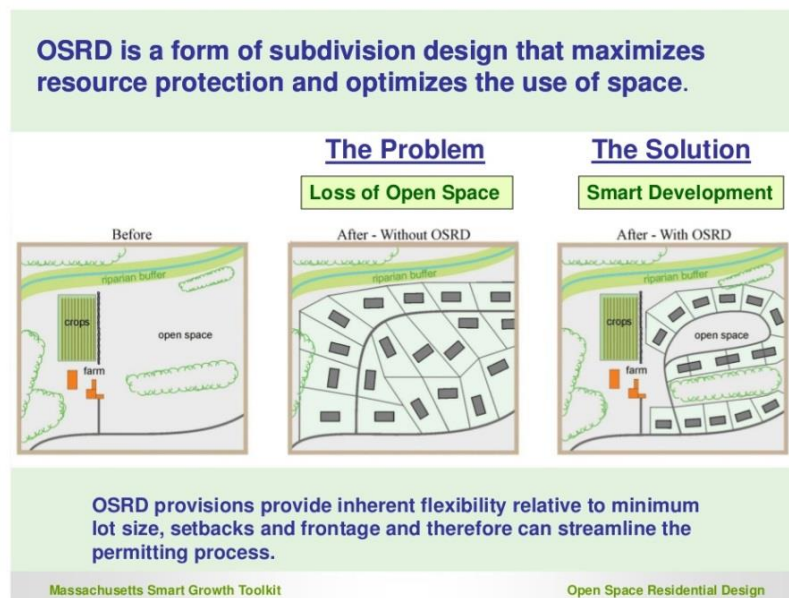


Figure 3: Massachusetts Smart Growth Toolkit visual comparison of conventional subdivision to open space residential development.

In Massachusetts the rate of land developed for residential and commercial use has surpassed the needs of the current population creating an excess of unused development (Gaertner, 2011). This development has created problems for communities across the state; including a lack of diversity in housing options, a threat to natural resources, and a loss of “community character”. One solution proposed by the Massachusetts Smart Growth Toolkit is to use open

space development and natural resource protection zoning. These methods are encouraged to be used together to allow for protection from many of the problems caused by residential sprawl.

In 2010, over 40 percent of Massachusetts municipalities had adopted some form of residential cluster zoning bylaws (Gaertner, 2011). As early as 1993, Assabett Estates was developed on 32.6 acres of land in Westborough, Massachusetts as an “open space community development” (Belansky & Justus, 2000). Seventy-four percent of the parcel was reserved for open space and the roadway constructed was 30 percent less than if it had been a conventional development. The developer created a homeowner's association to manage the open space. He claimed that creating an open space community did not significantly decrease his profits compared to construction of a conventional development, because the infrastructure savings were significant.

Another example of a successful open space residential development is the Woodbury Ridge development in Bellingham, Massachusetts (Belansky & Justus, 2000). Developers placed houses on six of the 16 total acres, which allowed for 10 acres of open space. The development created a number of benefits for homeowners including walking trails and scenic views from their houses. These benefits increased the appeal of the houses in spite of small lot sizes. The town Planning Board accelerated the review process due to the use of open space which saved the developer engineering costs (“Open Space Design/Natural Resource Protection Zoning,”).

2.2.2 West Boylston

RCD in West Boylston incorporates aspects of the open space design and natural resource protection zoning. The concept of RCD was presented to West Boylston, Massachusetts in 2010 (T. o. W. Boylston, 2010). Vincent Vignaly, a member of the West Boylston Planning

Board, recounted that the first proposal of open space zoning to the Town Meeting failed to pass due to criticism that it allowed higher densities from the voters. Local citizens were quick to refuse the system because it did not seem consistent with the town's character, and many were under the impression that it would result in higher population densities. Mr. Vignaly explained RCD would not change the population density of the area, but instead, would use the property more efficiently in order to maintain more open space and provide buffers separating existing abutters from the developed portion of the site. The town decided to implement a 30-foot vegetated buffer along roads and perimeter property lines in order to maintain the rural and private character in the town. In spite of the initial apprehension at the October 18, 2010 Town Meeting, the bylaw was ultimately passed (Hopewell, 2010; Vignaly, 2014).

RCD is a feasible solution to many of the housing challenges faced in West Boylston. High population density developments, such as developments under Massachusetts General Laws, Chapter 40B, often stress the existing water, sewer, parking, and transportation systems. Projects under 40B may request reductions from the West Boylston Zoning Bylaws minimum standards if 20-25% of the development is designated to be subsidized housing as defined by the Massachusetts Executive Office of Housing and Economic Development (*Chapter 40B Land Area Minimum*). The developer may appeal to the State Housing office, which often results in their approval of significantly higher densities than generally allowed under local zoning. These higher densities may not be compatible with the existing character of a neighborhood and will likely require additional costs for the town and developer to improve the infrastructure.

The Department of Conservation and Recreation (DCR) provides significant open spaces within West Boylston when it purchases property or development rights for land. The use of the RCD could help the DCR by protecting the land in environmentally sensitive areas. There are many clear benefits to RCD in West Boylston, however the feasibility is still unclear. A strategic plan is

needed to coordinate the Planning Board, Affordable Housing Trust and Building Department to capitalize on the density, monetary, and environmental benefits of RCD for the town.

2.3 RCD Plan Development

The planning process for a subdivision in West Boylston requires the designer and developer to follow the Site Plan Review town bylaws and regulations. Zoning Bylaw 3.11 outlines the procedures and details pertaining to RCD in the town. According to bylaw 3.11.E, all RCD applicants are encouraged to request a pre-application meeting with the Planning Board to discuss the project. They, then, must submit an application package that includes a Preliminary Subdivision design and an RCD subdivision design to the Planning Board. The Planning Board will then hold a public hearing to review the application and may require modifications to the design. After the hearing, the Planning Board will issue its decision in the form of a Definitive Subdivision Plan Approval.

In addition to the RCD bylaw, the town has local subdivision regulations that provide more specific design requirements. Although not all dimensions listed in the design regulations pertain to RCD, basic sewer, road, and others may still apply. The process ensures the buyer that the land is suitable for its intended use, that the infrastructure is adequate, and that the public safety, health, and welfare is protected (Anderson, 2000).

After filing the Preliminary Subdivision Site Plan, the designer is then required to submit a Definitive Site Plan. This document will take into consideration the critiques and concerns of the Planning Board and also include more detail than the Preliminary. The specific details that are needed are often specified by the town/state. Specific details for West Boylston site plans and procedures can be found on the town website under the Planning Board Rules and Regulations page. Depending on these specifications, the Definitive Site Plan will be reviewed by multiple

agencies and a public hearing will be held before it passes. When the document is approved, the required building permits may be issued. Disapproval of the site plan will require changes or additions to the plan and resubmittal at a later date(W. Boylston, 2007).

3 Methods

The goal of this project was to propose recommendations to the Town of West Boylston to help encourage RCD in the community. To accomplish this goal the main objectives were as follows:

- Identify challenges restricting the use of RCD in West Boylston.
- Identify methods to attract the use of RCD in West Boylston.

The team addressed these two objectives by completing a methodology which included interviews with local developers, engineers, and town personnel along with the creation of a Preliminary Subdivision design per West Boylston Bylaw 3.11.E. The sections below outline the purposes and processes of each individual method in relation to the main objectives.

3.1 Interviews

The interviews for this project were conducted in many forms including, face-to-face interviews, phone interviews, and conversations with town boards. The conversations were structured by a set of predetermined interview questions, however, the questions were intended to allow the interviewee to discuss topics specific to his interest or background experience (see Appendix B). This flexible structure allowed for proper discussion on topics that the group might have previously overlooked. Furthermore, all interview information was kept confidential unless otherwise allowed by the interviewee.

The group conducted interviews with the local engineers, town officials, and developers listed below:

- Developer for 55+ Community in West Boylston
- Jeff Perkins - Former Developer in West Boylston

- Leon Gaumond - West Boylston Town Administrator
- David Eckhardt - West Boylston Conservation Commission Member
- Paul McManus - Ecotec, Inc.
- Anthony Sylvia - West Boylston Director of Public Works

The interviews intended to gain information on two topics. First, the group collected information regarding the conditions and needs of the Town of West Boylston. Second, the interviews offered insight on the design process and cost differences of traditional and RCD preliminary site plans.

3.1.1 Interviews Pertaining to West Boylston

An interview with Leon Gaumond, Town Administrator, and discussions with the Planning Board and Conservation Commission offered insight from the local government on development in West Boylston. In these interviews, the team inquired about the character of the Town, recent development projects, and the Town's vision for the future. These Town views along with information provided in the West Boylston Housing Production Plan and Master Plan indicated the type of development the Town needed and locations available within the Town.

Interviews were also conducted with developers who have experience in West Boylston to explore the site design and application process from a developer's perspective. Data collected from these interviews were intended to help understand obstacles of the development process in West Boylston.

3.1.2 Interviews Pertaining to Site Design

The interviews were also helpful in understanding the technical aspects of the design process. Interviewees discussed how to conduct a site plan analysis and develop a plan accordingly. The

interviewees had experience with varying types of subdivision designs and locations. This experience was valuable because the interviewees were able to provide insight on effective design procedures with differing conditions. One interview was conducted on the selected site with a member of the Conservation Commission. During this interview, the interviewee addressed design challenges that were specific to the site. This information was helpful in molding the second method of this project in which the team developed a site plan design for a Town-owned parcel in West Boylston.

3.2 Site Plan Development

The team analyzed the site and created two different residential subdivision designs. A parcel was selected for design based on recommendations from the local town Planning Board. A traditional subdivision plan was created first to determine the basic density of the parcel per West Boylston Bylaw 3.11.D. Basic Density is defined as “the number of residential dwelling units or lots as allowed in the zoning district [...] and without waivers to West Boylston Subdivision Regulations,” per West Boylston Bylaws 3.11.B. Second, the team created an RCD, using the calculated basic density for the number of dwelling units.

3.2.2 Site Analysis

To begin the site design process the team analyzed the site using data collected from a site walk, MassGIS, and a site evaluation with a wetlands scientist. The team also collected information regarding utility access from local town officials.

3.2.2.1 Site Visit

The team visited the selected parcel to take pictures and document the existing conditions. This was the first step in the conceptual design process because it established physical limitations of the site. The following criteria were considered while observing the site:

- Slope of the land
- Vegetation
- Adjacent properties
- Wetlands
- Streams/bodies of water
- Soils
- Existing drainage
- Existing utilities (fire hydrants, electricity, sewage, lighting, roadways)
- Permeability of surfaces
- Access
- Open space

The initial site walk helped the team understand many opportunities and restrictions present on the site, but a further detailed analysis was required. The next steps in the process, GIS and eventually correspondence with the town, provided more accurate and detailed analysis.

3.2.2.2 GIS

Geographic Information Systems (GIS) is a computer program that stores location based information. The team worked in ArcMap 10, an ArcGIS program, to conduct a site plan analysis. The data for the analysis was downloaded from the Massachusetts Office of GIS

(MassGIS) website. The following datalayers were used for the site plan analysis: Digital Orthophoto Elevation Points, MassDEP Wetlands, MassDOT Road, Contours 1:500, Zoning, and Level Three Assessor's Parcels. These data layers were then used to create a basic understanding of the features of the site including slope differences, types of soil, wetlands, streams, accessibility, parcel boundaries, and town zoning.

3.2.2.3 Wetlands Analysis

From the GIS data, the team identified wetlands on the property per the MassDEP Wetlands layer. As a result, the team contacted the West Boylston Conservation Commission to determine wetlands restrictions on the property. The Conservation Commission recommended contacting a local wetlands scientist to verify the presence of wetlands on the property and define the location of the wetlands. The team then walked the site with Paul McManus, a local professional wetlands scientist of EcoTec, Inc., to delineate bordering vegetated wetlands on the property. The team first identified wetland plant species to determine locations to sample the soil. The team then used soil samples and the Munsell Soil Color Chart to determine where wetlands soils existed that coincided with wetland plant species. MassDEP defines wetlands as a location where both wetland soils and plant species exist.

3.2.2.4 Local Utilities

After analyzing the parcel using GIS, the team verified the availability of utilities on the site by contacting local town officials. The team contacted the Director of Public Works to confirm sewer access and capacity at the site. The team also contacted the West Boylston Water District to obtain information regarding water accessibility and pressure at the site. Lastly, the team obtained information regarding natural gas accessibility at the property from the Conservation Commission.

3.2.3 Site Design

Following the Site Analysis, the team began the site plan design. AutoCAD Civil 3D was the primary computer program used to during the process. The team began by importing the GIS information used during the site plan analysis into AutoCAD Civil 3D. The team then performed a watershed analysis, designed conceptual traditional and RCD plans, graded the site, and completed a cost estimate.

3.2.3.1 Contours/Surface Topography

The team used contours to help establish an understanding of the topography of the site. The surficial topography, created from the Digital Orthophoto Elevation points for the 177902 and 181902 quadrangles on MassGIS, helped the team establish a drainage analysis, and grade the site. To create the surface, the team imported the GIS data points into AutoCAD Civil 3D, and created a two-foot contour TIN Surface.

3.2.3.2 Drainage Analysis

After the creation of the TIN Surface, the team completed a hydrologic analysis for the existing conditions of the surface. First, using the previously created surface, the team defined the drainage areas on the site and determined the points of interest where water originally discharged from the site. These points were used to ensure that the existing flows from the site were not increased in the design.

Second, the team used the Rational Method as stated in the Hydrology Handbook for Conservation Commissioners to determine the peak discharge (Q_p) for the noted drainage areas the existing site and RCD single family design conditions (Nyman, 2002). The comparison of

pre and post development peak discharges was used to design for rough sizing of drainage and stormwater treatment areas needed on the site.

The calculations were conducted using the equation shown below in Table 1 and a 24-hour, 100-year storm per West Boylston Zoning Bylaw 3.6.F.

Table 1: Rational method equation.

Rational Method
$Q_p = CiA$ <p>Q_p = Peak Discharge (cfs) C = Runoff Coefficient (dimensionless) i = Rainfall Intensity (in/hr) A = Watershed Area (ac)</p>

The team determined values for “i” by using town regulations in accordance with an Intensity/Duration/Frequency (IDF) Curve for Worcester Massachusetts from the Mass Highway Drainage Manual (*Project Development & Design Guide*, 2006). The team used Manning’s Kinematic Solution to calculate the time of concentration to determine the rainfall intensity on the IDF Curve (*Urban Hydrology for Small Watersheds TR-55*, 1986). The calculations for stormwater drainage can be found in Appendix C.

To determine runoff coefficients for each drainage area, the team overlaid a google aerial image under the previously created Civil3D watershed map. The team assigned runoff coefficients from Exhibit 8-8 in the Mass Highway Manual to areas of land based on the character or description of the image. The team also used knowledge of the site's current conditions to influence the calculations as the most current satellite images were taken before the removal of a building on the site. The team interpolated a runoff coefficient for each drainage area by using a weighted average for all conditions present in the area. This was completed within reasonable accuracy based on a recent google image and site visits.

After the RCD subdivision design was complete, the team conducted a hydrologic analysis for the new design. The team used the AutoCAD Civil 3D drawing to calculate the area of impermeable surfaces from the roofs and pavement. The team created three major drainage areas for the calculations; one along Prescott Street, one along Horseshoe Drive, and one that collected in the center of the cul-de-sac. The team then combined flows from the original analysis to compare the before and after stormwater runoff from the site.

3.2.3.3 Stormwater Design

From the hydrologic analysis, the team assembled a list of possible best management practices (BMPs) for stormwater management on the RCD and traditional designs. The team selected BMPs based on the Conservation Commission Hydrology Handbook and other sources. The team also considered low impact development methods and the needs of the local residents.

3.2.3.4 Traditional Subdivision Design

The next step of site design was to create a conceptual layout in AutoCAD Civil 3D. The team first created a traditional layout design to calculate basic density for the number of lots possible

at the site per West Boylston Zoning Bylaw 3.11.E. The team followed the West Boylston Zoning Bylaws, other local departments' bylaws, and state laws.

To calculate basic density, the team designed the subdivision to optimize the number of lots permitted on the property while maintaining the existing town recreational field space and considering constructability near assumed wetlands per MassGIS. The team first designed the right-of-way and road to maximize the number of lots that could be designed around the road. The right-of-way for the road was designed to a minimum of 50 feet per Subdivision Regulation VI B. The subdivision also accounted for approximately 0.4 acres of un-buildable area on the lot due to the presence of perceived wetlands. The team assumed the footprint for a house to be approximately 1,500 square feet similar to the houses to the northeast of the property to ensure the lots had proper frontage and setbacks per the West Boylston Zoning Bylaw 4.2. The property was zoned for Single Residence per the Town of West Boylston Zoning Map and therefore required the dimensions seen in the top row of the Table 2 below.

Table 2: West Boylston Zoning Bylaw 4.2 Schedule of Dimensional Requirements.

DISTRICT	Min. Lot Size	Min. Lot Frontage (In feet)	Min. Yards (In feet)		
			Front	Side	Rear
Single Residence	40,000 square feet	120	25	10	10
General Residence	40,000 square feet	120	25	10	10
Business	1 acre	150	10	10	10
Industrial	2 acres	150	50	10	10
Aquifer Protection	50,000 square feet	150	25	10	10

The traditional design was used to determine the basic density of the parcel. This basic density was used later to determine how many lots were allowed in the RCD design. The traditional

subdivision design allowed the team to experience obstacles in creating this type of design that could later be compared to the creation of an RCD design.

3.2.3.5 RCD Subdivision Design

The second step in the design process per Zoning Bylaw 3.11 was to create an RCD design. The basic density from the traditional subdivision design defined the number of lots permitted in the RCD subdivision. Based on results from the interviews with town officials, the team decided to incorporate additional field space into the RCD design as part of the open space requirement. The team attempted different designs accounting for recreational fields, parking, and residential accessibility. The team considered single-family, multi-family, ownership and rental type, and continuous care retirement housing as possible variations in design standards.

Ultimately, the team used RCD Zoning Bylaw 3.11 as standards for the design. For an RCD, lots were required to be a minimum of 5,000 square feet with 50 feet of lot frontage. The required setbacks were 10 feet on all sides with a 50 foot buffer around the entire perimeter.

3.2.3.6 Grading

The team used AutoCAD Civil 3D for the majority of the grading. For each design, the road was graded to contain low and high points to allow for stormwater management. Low points were considered where space for stormwater management was available and the high points were placed to encourage down-grading to the low points. The fields and parking lot were also graded as part of the stormwater management system to drain the water towards the low points on the road.

The road surface, fields, and parking were graded to the existing surface to optimize cut and fill on the site. The existing surface was compared to the final design surface to calculate the amount of earthwork needed on the site.

3.3 Review with Local Agencies

Throughout the project, the team consulted Vincent Vignaly, a member of the West Boylston Planning Board, for input on their work. The team presented their initial proposal and designs for RCD and traditional subdivisions to Mr. Vignaly. After completing the design, the team presented the results of their project to the West Boylston Planning Board for feedback from the Board and local residents.

3.4 Cost Estimation

The team used Mass DOT cost data to estimate basic construction costs of the proposed site designs and compare the costs for the traditional and RCD subdivision designs. The team used AutoCAD Civil 3D to determine the area of road and sidewalks for each design and calculated the total costs for both. The team also used the cut/fill feature of AutoCAD Civil 3D to determine the total volume of soil grading in both traditional and RCD designs. These amounts were compared later to analyze the benefits of an RCD versus a traditional subdivision.

4 Results

The group obtained data from the methods previously discussed. Data from Method 1 Interviews, was recorded with notes and meeting minutes and further coded into specific categories of relevance. The data received is analyzed below and listed by category in Appendix B. Data from Method 2 Site Plan Development was not explicit. The valuable information came as a result of exercise. A “Daily Site Plan Development Log” was used to identify and organize data from the site plan development exercise. This log can be found in Appendix D. The coded interview data and Site Plan Development Log entries were used to present the data for analysis.

4.1 Interviews

The team conducted interviews with the local engineers, town officials, and developers listed below:

- Anonymous Developer for 55+ Community in West Boylston
- Jeff Perkins - Former Developer in West Boylston
- Leon Gaumond - West Boylston Town Administrator
- David Eckhardt - West Boylston Conservation Commission Member
- Paul McManus - Ecotec, Inc.
- Anthony Sylvia - West Boylston Director of Public Works

From the interviews the team found that developers have different processes regarding subdivisions. One developer bought the land over time, consulted the DCR first to learn about restrictions on the property, and then waited for a town sewer line and improved economy

before approaching the town about development. The other developer hired an engineer to design the subdivision and approached the town for local feedback before acquiring the land.

During the interviews, the team also found overall and local benefits to RCD. Overall, developers expressed interest in RCD due to the flexibility of land use. They also acknowledged the benefit of flexibility in housing cost, whether market rate or affordable. Locally, the interviewees believed RCD could help create subdivisions while working around many of the conservation restrictions in West Boylston associated with the reservoir. The Town also has a shortage of recreational facilities and fields which could be improved if developers used RCD and maintained the open space for such facilities.

The team also investigated the advantages and disadvantages to developing within West Boylston through the interviews. One interviewee believed the Town's entire approval process was slow and convoluted because of the lack of intercommunication among the different boards. This developer believed that a process with one representative from all boards for design review could accelerate the process. An interviewee also mentioned local resistance existed to change and developments in West Boylston. On the other hand, one interviewee mentioned how cooperative the Town of West Boylston was for developers because of the "low dollar" economy of the town. This developer believed West Boylston was much easier to work with as a developer compared to towns in the Metrowest region of Massachusetts.

From the team's first meeting with the West Boylston Planning Board, the board recommended using the Mixter parcel for the team's feasibility study of RCD in West Boylston. From the interviews and further research, the team found the property had previously contained a school and then a town municipal building. The building had been demolished and all PCP and asbestos had been removed. Part of the property is now used as recreational fields and the

remaining property is untouched. From the interviews, the team found sewer access was available for the property through a Town easement. The team was also notified of water and natural gas access for the property.

From the interviews, the team found that the overall housing needs of the Town of West Boylston included rental units for younger and older residents to maintain diversity within the town's population. The team also found that recreational facilities including trails and fields are much needed in the town, especially in the area surrounding the Mixter parcel. This information was used later for site design of the Mixter parcel.

4.2 Site Plan Development

The team analyzed the site and created two different residential subdivision designs on the Mixter Parcel. First, the team created a traditional subdivision design and determined the basic density to be ten units on the property if the existing field is maintained. Second, the team created an RCD, for ten dwelling units in both a single-family design and a duplex design.

4.2.1 Site Analysis

To begin the site design process the team analyzed the site using data collected from a site walk, from MassGIS, and a site evaluation with a wetlands scientist to determine restrictions on the property. The team also collected information regarding utility access from local town officials.

4.2.1.1 Site Visit

The first form of site analysis conducted on the 120 Prescott Street parcel was a site visit. The visit provided a visual analysis of the property's character and features. The initial visual analysis was important to understanding some of the limitations and opportunities of the parcel.

The team found that 120 Prescott Street property was a large plot of land with an existing driveway which extended toward the middle of the property where a building previously stood before it was removed (see Figures 4 and 5). There was also a youth soccer field and little league baseball diamond on the property adjacent to Prescott Street.



Figure 4: Image of the east side of the property from team site visit to Mixter parcel.



Figure 5: Image of property from team site visit to Mixer parcel.

During the site visit the team was able to analyze the constructability of the land by observing the existing features and characteristics. The slope and vegetation of the land indicated where development would have the least impact. As seen above, a significant portion of the land was relatively flat and did not have any vegetation. This section of land was located in the front of the property adjacent to Prescott Street. Alternatively, land towards the east side of the property was wooded and had a slight downward slope toward the back of the property. Because of this characteristic, development of roads, homes, and fields would be most practical on the front section of the parcel because it would minimize clearing and grading costs. In addition, the existing road access to the property was on the west side of the property facing Prescott Street. Constructing closer to Prescott Street would yield a shorter road and as a result minimize material volumes and impermeable surface area.

Existing utilities on the site were also a point of interest during the site visit. Figure 6 shows the fire hydrant on the property which had previously served the old school building. Although the water pressure and available flow were unknown, this indicated that water utilities were already available on the site allowing for development.



Figure 6: Fire hydrant on Mixer property from team site visit.

Although the main access to the property connected to Prescott Street, there was also a walking access connecting the back of the property to Horseshoe drive. The access connected to Horseshoe Drive between two houses in a residential neighborhood (see Figures 7 and 8). This path allowed residents access to the fields and open space on the property.



Figure 7: Map of Mixer parcel showing path to Horseshoe Drive.

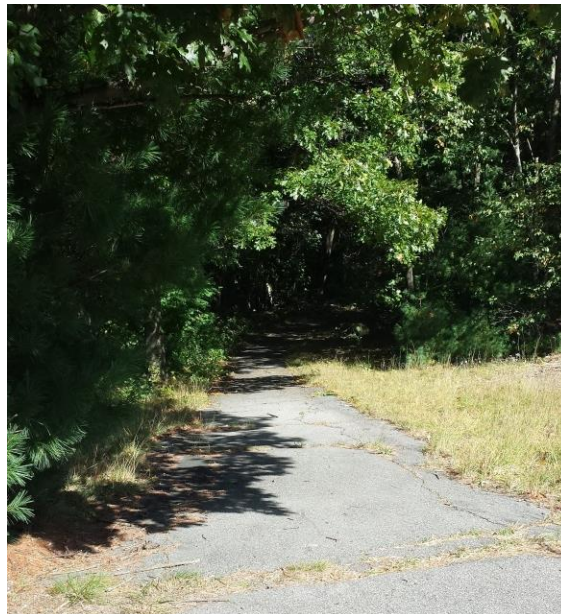


Figure 8: Walking path on east side of property connecting to Horseshoe Drive.

4.2.1.2 GIS/Online Data

After assessing the property on site, the team retrieved GIS data on the property for a more accurate analysis. The size (13.7 acres) and shape of the parcel was precisely defined which indicated exactly what land was available. Additionally, a GIS investigation indicated that wetlands and a stream were present on the back portion of the property. The presence of these natural features restricted the use of portions of the land per the local Conservation Commission.

Part of these restrictions could include a buffer zone which further reduced buildable area adjacent to the wetlands. The location of the wetlands in the parcel encouraged development towards the front of the property to avoid environmentally sensitive areas. Secondly, the GIS

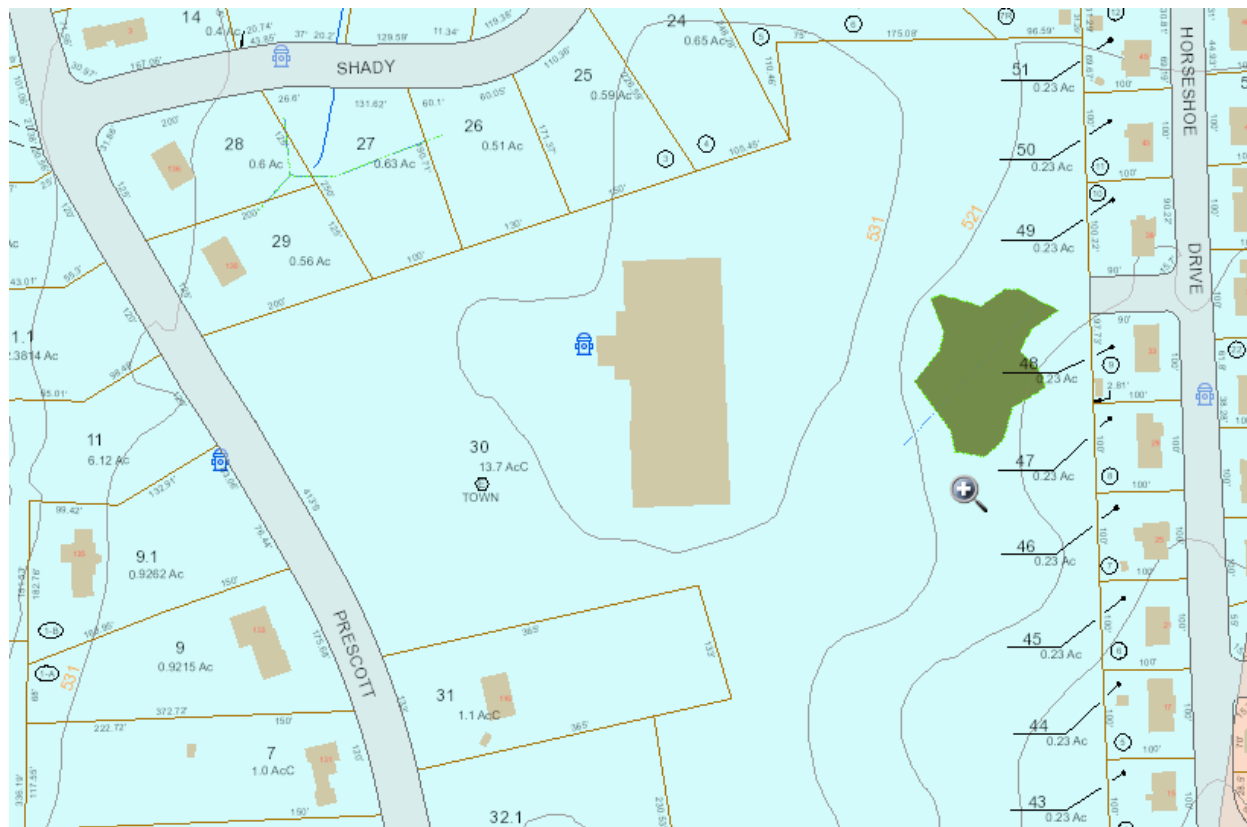


Figure 9: Town GIS image showing features of Mixer parcel.

data allowed the team to more accurately analyze the slope of the parcel. Three meter (as seen below) and two foot contour lines were generated through MassGIS. This data confirmed that the Horseshoe Drive side of the property would require more grading than the Prescott Street side.

In addition to physical characteristics of the land, the team determined that the parcel was zoned for Single Family Residential from West Boylston town documents. This limited the use of the land to the zoning requirements unless overridden by special circumstances.

Lastly, online data from the USDA Natural Resources Conservation Service, Web Soil Survey, indicated that the soil on the property was defined as 305B Paxton Fine Sandy Loam at a three to eight percent slope on one section, and 305C Paxton Fine Sandy Loam at eight to 15 percent slopes on the remaining property. Figure 10 showed the areas of land covered by each type of soil on the parcel("Web Soil Survey," 2013).



Worcester County, Massachusetts, Northeastern Part (MA613)			
305B	Paxton fine sandy loam, 3 to 8 percent slopes	9.6	9.6%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	61.1	60.9%

Figure 10: Web soil survey data for Mixer property.

4.2.1.3 Wetlands Analysis

From the wetlands analysis with Paul McManus, the team did not find evidence of wetlands in the area denoted on the MassGIS datalayer. The team identified only upland plants and non-hydric soils in the area. Although the team did not complete a full analysis, one area of the property towards the southeast corner contained hydric soils and wetland indicator plants. This area of the property may be deemed a wetland but further analysis will be necessary before development. For this project, the team assumed the MassGIS data was correct and avoided development throughout the densely vegetated areas of the lot for the RCD design.



Figure 11: Team wetlands analysis using soil samples.

4.2.1.4 Local Utilities

The team consulted with multiple local utilities to further understand the limitations and opportunities on the 120 Prescott parcel. To evaluate the availability of water on the property, the team received a West Boylston Water Department Hydrant Flow Data Summary from 1995. In spite of the nine-year difference, none of the involved infrastructure had changed and therefore the data was assumed to be current. The team also received a map of Water Distribution Systems in West Boylston. The map indicated that 120 Prescott Street has a six-inch diameter water main coming on to the property tied to an eight-inch diameter water main on the street (see Figure 12).

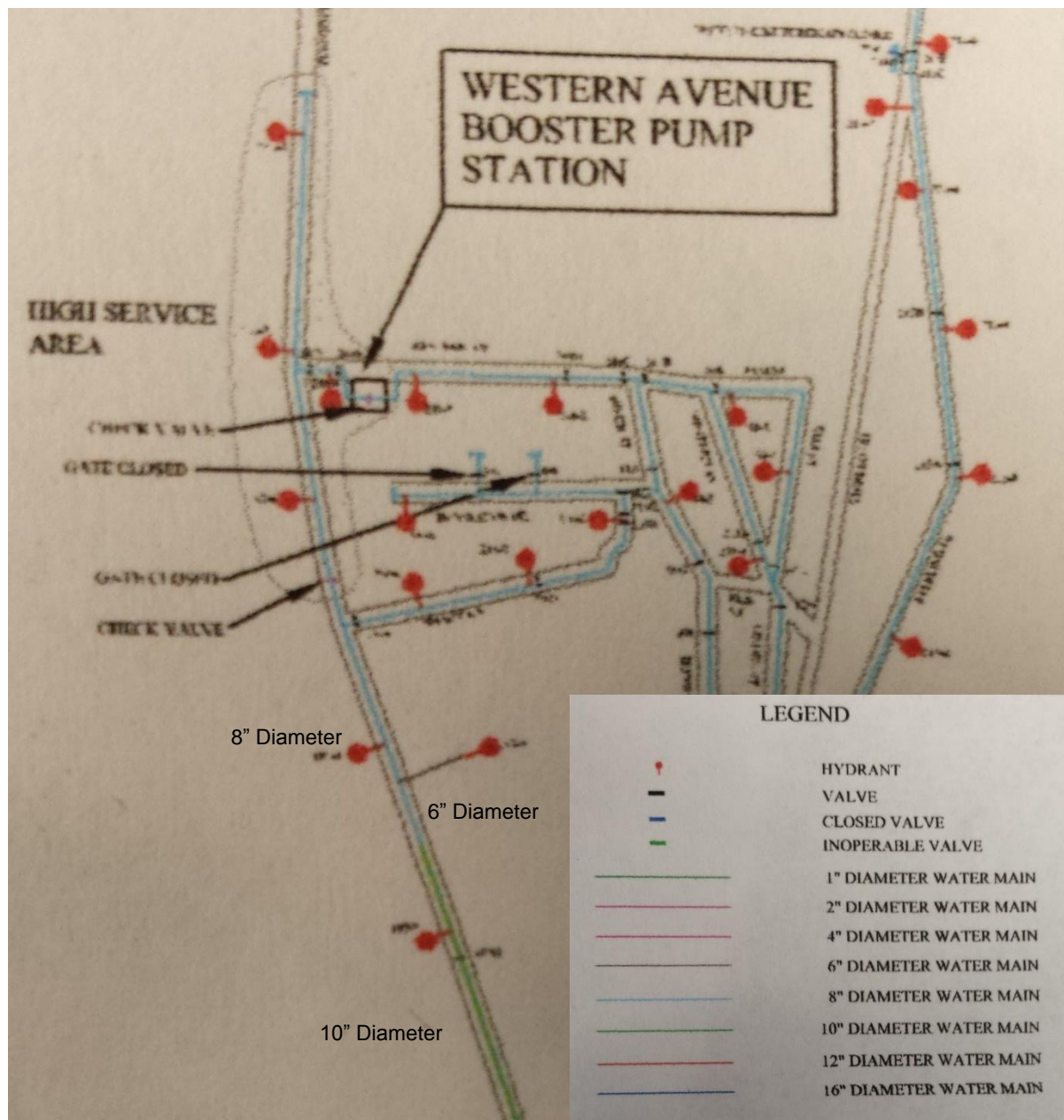


Figure 12: West Boylston Water Department Hydrant Flow Data Summary.

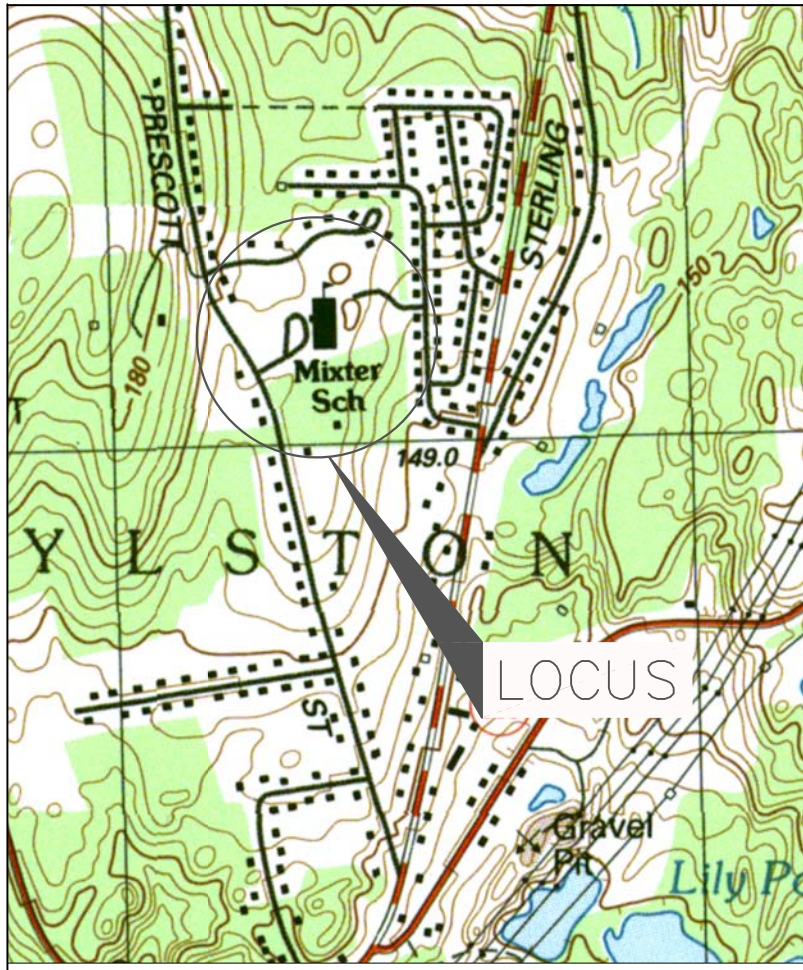
4.2.2 Site Design

The team designed three site plans; a traditional subdivision plan to determine the basic density, a single family RCD plan, and a duplex RCD plan. The following sections describe and analyze each design. The site currently contains one multi-use recreational field and

approximately 4 acres of cleared land while the remainder of the property is wooded. The resulting characteristics of each site design is compared in Table 3 below. For this section, the drawings for each design are included at the beginning of the respective description.

Table 3: Site design results comparison.

	Traditional	RCD	Duplex
Number of Lots	10	10	5
Minimum Lot Size	40,075 S.F.	5,430 S.F.	14, 424 S.F.
Number of Dwelling Units	10	10	10
Average Dwelling Unit Size	2,057 S.F.	1,000 S.F.	1,000 S.F.
Vegetated Buffer	none	30FT Perimeter	30FT Perimeter
Open Space	none	458,115 S.F.	458,115 S.F.
Recreational Areas	One 50YD X 100YD Soccer Field	Two 55YD X 87 YD Fields & Playground	Two 55YD X 87 YD Fields & Playground
Parking Spaces	35	32	36



TRADITIONAL HOUSING		
NUMBER OF LOTS		10
NUMBER OF DWELLING UNITS		10
DWELLING UNIT SIZE		2,057 S.F.
OPEN SPACE		78,835 S.F.
RECREATION SPACE	100YD X 50YD SOCCER FIELDS & PLAYGROUND	
PARKING		35 SPACES
ROAD LENGTH		1,298 FEET

NOTE: SEE SHEET 4 OF 4 FOR ROADWAY CROSS SECTION FOR PAVEMENT WIDTHS, SIDEWALK, AND UTILITY LOCATIONS.

REVISIONS:

WEST BOYLSTON PLANNING BOARD:

DATE OF APPROVAL:

DATE OF ENDORSEMENT:

TRADITIONAL PRELIMINARY
SUBDIVISION PLAN IN
West Boylston,
Mass.

PREPARED FOR
The West Boylston
Planning Board

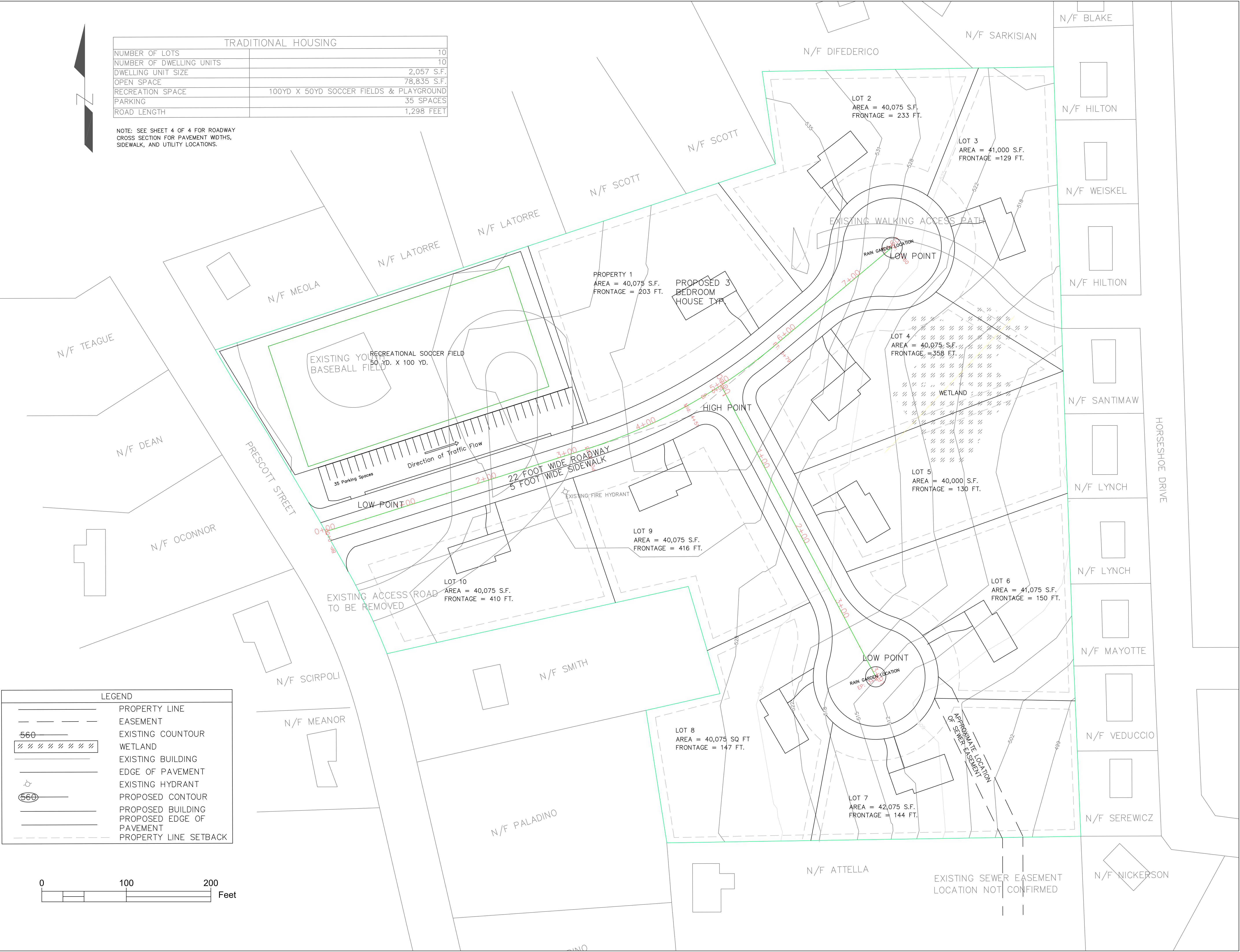
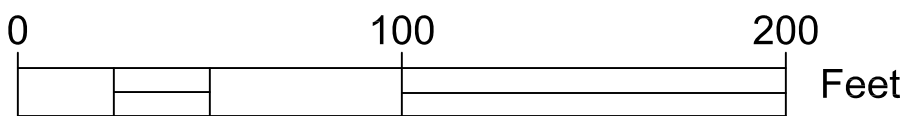
PREPARED BY
WPI STUDENTS:
MELISSA LANDI,
CHRISTOPHER LONG
& BRIANA WEISGERBER

DECEMBER 10, 2014

SCALE: 1"=50'

PAGE 1 OF 4

LEGEND	
	PROPERTY LINE
	EASEMENT
	EXISTING COUNTOUR
	WETLAND
	EXISTING BUILDING
	EDGE OF PAVEMENT
	EXISTING HYDRANT
	PROPOSED COUNTOUR
	PROPOSED BUILDING
	PROPOSED EDGE OF PAVEMENT
	PROPERTY LINE SETBACK



4.2.2.1 Traditional Subdivision Design

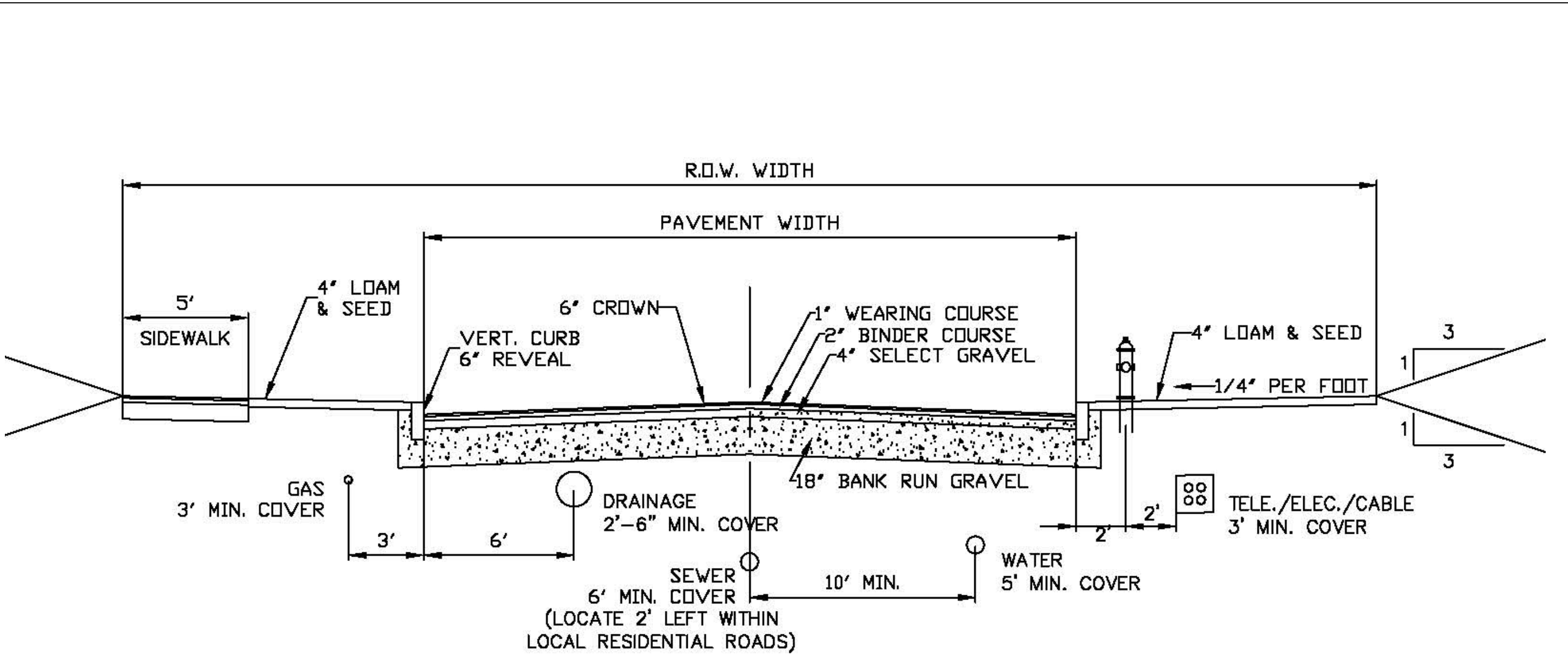
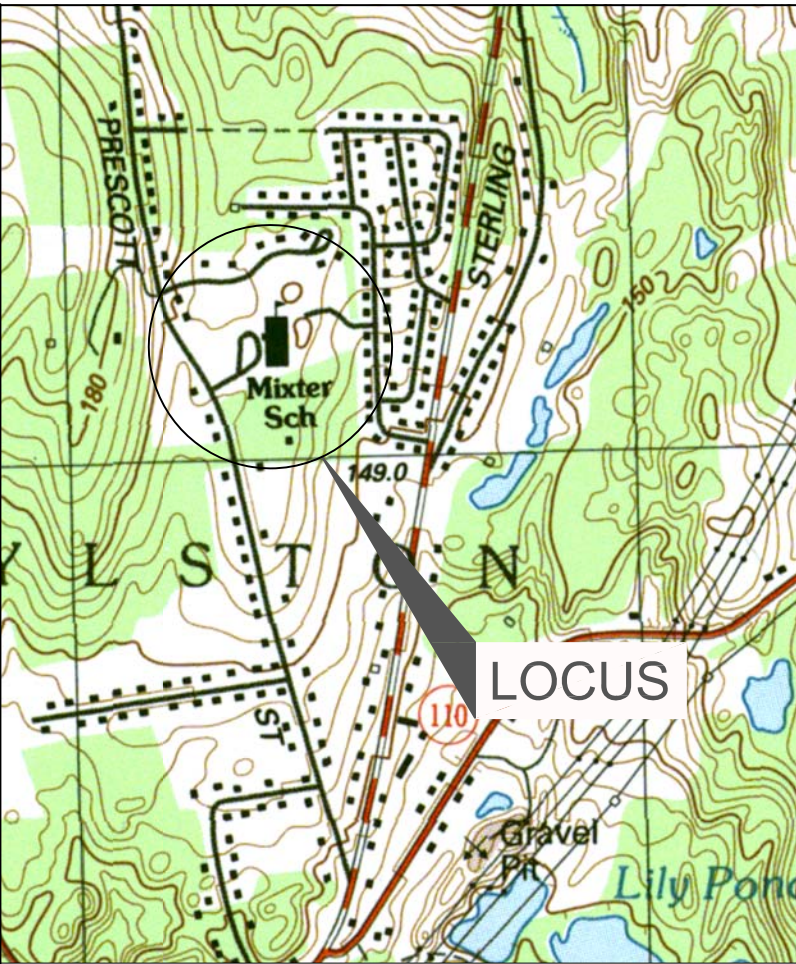
The traditional subdivision was created according to West Boylston Zoning By-Laws. The Mixer parcel traditional subdivision included 10 lots, one multi-use recreational soccer field, and a parking lot to accommodate the field. In accordance with West Boylston Zoning Bylaw 4.2, each residential lot was at least 0.92 acres with at least 50 feet of road frontage. Sample houses, garages, and driveways were also placed on each lot to illustrate the feasibility of the layout. The houses were approximately 1800 square feet and included a garage sized 20 feet by 27 feet. The sizes for the houses were selected based on the sizing of houses in the surrounding area.

As mentioned above, the subdivision contained one multi-use recreational field. Based on the Housing Production Plan, and the interview with Leon Gaumond, the team decided to keep the recreational field in the traditional design as it was important to the town. In this design, the team rotated the field 90 degrees in order to accommodate the road for the subdivision and parking for the field. The field size was also increased to 50 by 100 yards to be used as a full size soccer field or for younger age groups depending on Town needs ("Recommended Goal Sizes," 2012). A total of 35 parking spaces were included in the parking lot to accommodate the capacity of the field, with traffic flow in one direction and one entrance and exit. The parking spaces were designed to be nine by 18 feet with 20 feet allowed for traffic flow.

Beyond the parking lot and the soccer fields, residential lots covered the entire parcel. As a result, two of the properties contained wetlands and a stream limiting the design on those lots. All construction on these properties within a 100-foot buffer from the wetland resource would need to be reviewed by the Conservation Commission to determine the impact on the wetlands. Additionally, as the design covered the entire property, grading would be required throughout

most of the site. The grading would require increased impact to the land, especially in areas of the parcel with steep slopes. The need for 120 feet of frontage along each roadway for each lot also impacted the road, which split into two cul-de-sacs. The long road resulted in high material volumes and large areas of impervious surfaces which became costly a negative implication for stormwater runoff. Although many of the features of the traditional site plan were problematic, the main purpose of the design was to prove the feasibility of development on the parcel and determine the maximum allowable dwelling units.

For grading on the traditional site, the team did not complete a full analysis, but did determine that low points would exist in the center of the cul-de-sacs and at the entrance to Mixer Road from Prescott Street. This would allow for rain gardens to manage the stormwater at the center of the cul-de-sacs and subsurface infiltration along Prescott Street.



PROPOSED ROAD SECTION
NOT TO SCALE

LEGEND	
	PROPERTY LINE
	EASEMENT
	EXISTING COUNTOUR
	WETLAND
	EXISTING BUILDING
	EDGE OF PAVEMENT
	EXISTING HYDRANT
	PROPOSED CONTOUR
	PROPOSED BUILDING
	PROPOSED EDGE OF PAVEMENT
	PROPERTY LINE SETBACK

RESIDENTIAL CLUSTER DEVELOPMENT ZONING REGULATIONS	
MINIMUM PROTECTED OPEN SPACE	40 PERCENT
VEGETATED BUFFER (BORDERING PUBLIC WAYS, RESIDENTIAL DEVELOPMENT, OR RESIDENTIAL USES)	30 FEET WIDE, 8 FEET HIGH
MINIMUM LOT FRONTAGE	50 FEET
BUILDING SETBACK FROM PARCEL PERIMETER	50 FEET
INTERNAL LOT SETBACK	10 FEET
MINIMUM LOT SIZE	5,000 FEET (PER RCD),
MAXIMUM NUMBER OF DWELLING UNITS	BASIC DENSITY (MAX ALLOWABLE IN TRADITIONAL SUBDIVISION)
MINIMUM TRACT SIZE	5 ACRES

REVISIONS:

WEST BOYLSTON PLANNING BOARD:

DATE OF APPROVAL:

DATE OF ENDORSEMENT:

ROAD SECTION AND
PROFILE VIEW

West Boylston,
Mass.

PREPARED FOR

The West Boylston
Planning Board

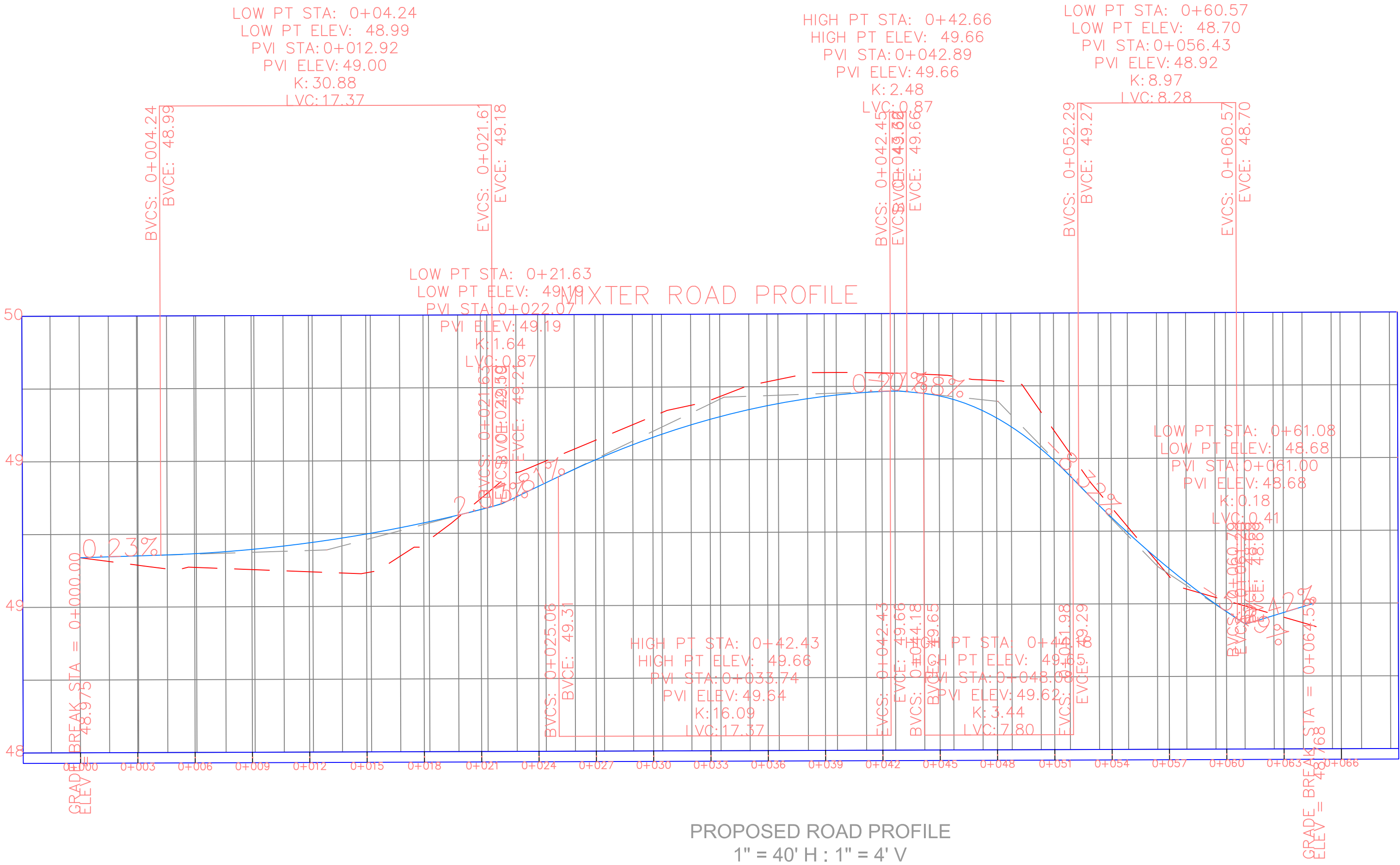
PREPARED BY

WPI STUDENTS:
MELISSA LANDI,
CHRISTOPHER LONG
& BRIANA WEISGERBER

DECEMBER 10, 2014

SCALE: 1"=50'

PAGE 4 OF 4



4.2.2.2 Residential Cluster Development

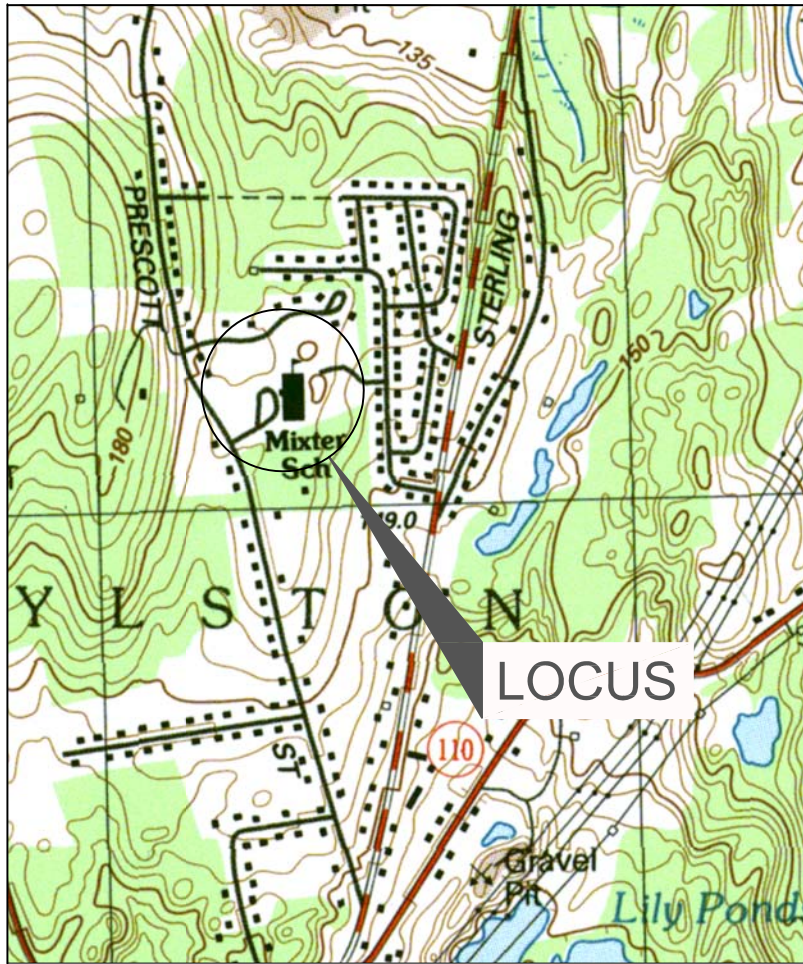
After completing the traditional site plan design, the allowable 10 dwelling units was used to design an RCD subdivision, seen in the included design. The design consisted of one road with a cul-de-sac, 10 lots with proposed houses, two soccer fields, a parking lot to accommodate 36 cars, a proposed playground, a walking path, and total of 458,115 square feet of open space. Essentially, West Boylston's flexible standards of RCD made this design much more valuable than the traditionally designed subdivision.

First and foremost, RCD standards allowed for only 50 feet of frontage and a minimum lot size of 5,000 square feet as compared to a minimum of 40,000 square feet for traditional subdivisions in West Boylston. This large difference allows for a great deal of flexibility of location and organization of the lots. The lots were arranged around a cul-de-sac which minimized the length of the road and therefore earthwork volumes. The shorter road also resulted in less impermeable surface area which reduced the amount of stormwater runoff. Accordingly, the reduction of runoff reduced any contaminants caused by the pavement and also reduced the capacity of drainage the team needed to design for. Moreover, lot placement in the RCD design was much more flexible due to the smaller lots. This allowed the team to place the lots in a location where it made minimal environmental impact. The placement avoided most of the sensitive wetlands and stream and also avoided the disruption of much of the wooded areas and steep slopes. These factors improve the constructability from a developer's point of view and reduced the total cost of the development.

The flexibility of RCD also allows for improvements of the community as a whole. As mentioned previously, the town valued maintaining the recreational fields on the property for town use. To meet this need, the large amount of open space in the RCD design allowed for two Town soccer

fields. In addition to the fields, the open space improves the facility because there is room for a playground in close proximity to the field and room for parking to accommodate enough cars for the two fields. This improved community space was also valuable to the surrounding neighborhood. In the existing conditions, a walking path connected Horseshoe Drive development area to the property. This path was lost in the traditional design because private lots stood between the Horseshoe Drive area and the field. However, the RCD design left the space open so that the path could be used for the neighborhood to access the fields and playground.

For grading on the RCD site, the team designed for two low points; one in the center of the cul-de-sac and one near the entrance to Mixer Road from Prescott Street. The team recommended considering a rain garden in the cul-de-sac and subsurface infiltration near the entrance to Mixer Road. The calculations for the existing conditions and design conditions can be seen in the Table 4.



RCD MULTI-FAMILY HOUSING	
NUMBER OF LOTS	5
NUMBER OF DWELLING UNITS	10
DWELLING UNIT SIZE	1,000 S.F. PER DWELLING UNIT
OPEN SPACE	458,115 S.F.
RECREATION SPACE	2 55YD X 87YD SOCCER FIELDS & PLAYGROUND
PARKING	36 SPACES
ROAD LENGTH	692 FEET

NOTE: SEE SHEET 4 OF 4 FOR ROADWAY CROSS SECTION FOR PAVEMENT WIDTHS, SIDEWALK, AND UTILITY LOCATIONS.

REVISIONS:

WEST BOYLSTON PLANNING BOARD:

DATE OF APPROVAL:

DATE OF ENDORSEMENT:

DUPLEX RCD PRELIMINARY
SUBDIVISION PLAN IN

West Boylston,
Mass.

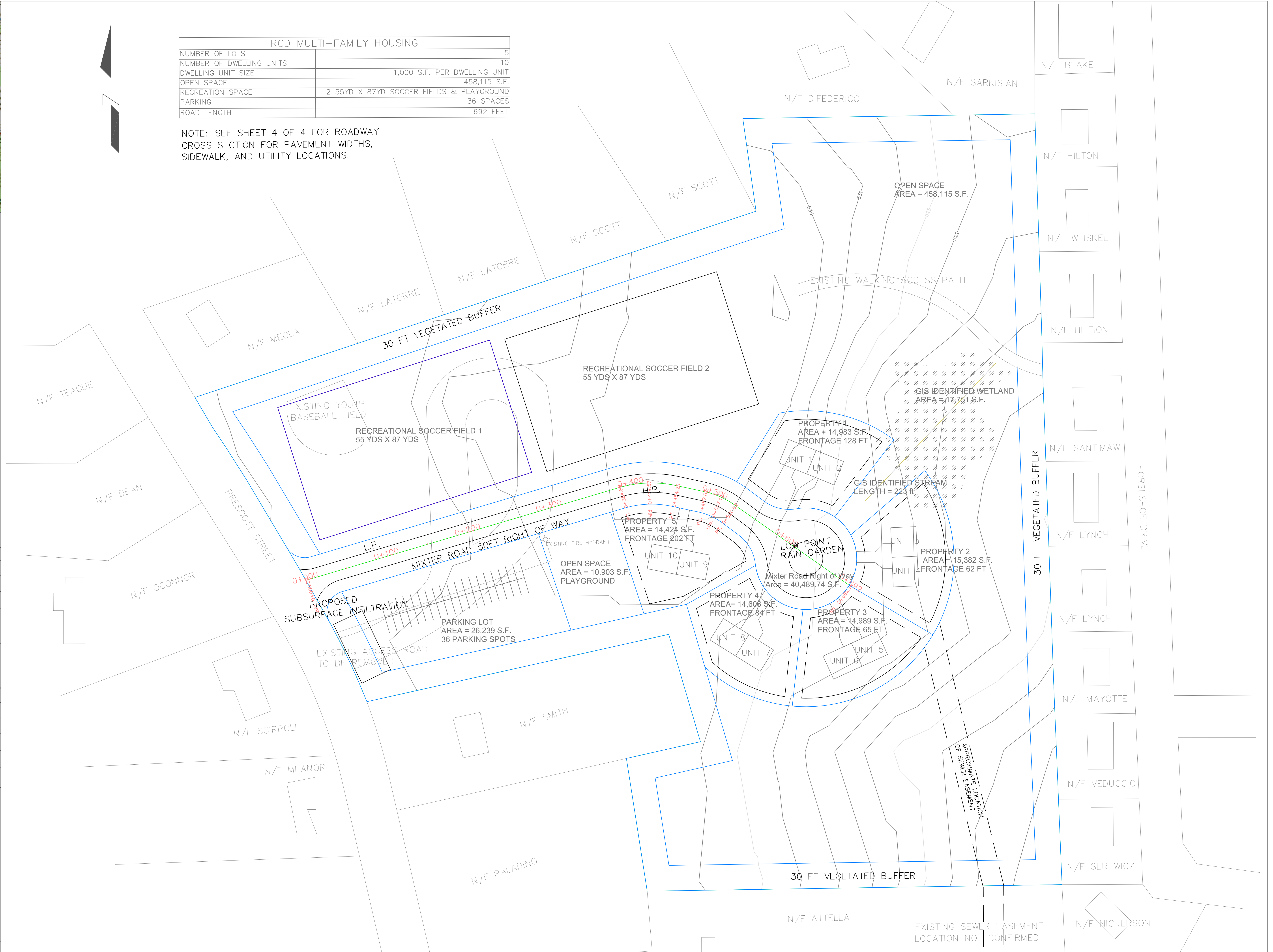
PREPARED FOR
The West Boylston
Planning Board

PREPARED BY
WPI STUDENTS:
MELISSA LANDI,
CHRISTOPHER LONG
& BRIANA WEISGERBER

DECEMBER 10, 2014

SCALE: 1"=50'

PAGE 3 OF 4



4.2.2.3 Duplex Subdivision Design

The duplex subdivision design was developed with the intention of satisfying the Housing Production Plan and Master Plan goals to provide rental spaces and homes for the 55 plus and recent college graduate population. Duplex housing also allows for the opportunity of affordable housing for Chapter 40B. As stated by the Housing Production Plan “West Boylston desires to provide housing options for a diverse range of households while preserving its vision of a community rural in character.” Duplex design allows the Town to diversify, while still maintaining the open space and character of the Town.

In addition the design accommodated for tight space issues in the original RCD plan. A few houses in the RCD design were only 25 feet apart, with driveways barely fitting on the property. The duplex plan allowed for each duplex to have more space between buildings and shared drives to cut down on surface area and relieve the clutter. The isolation of each duplex fits the character of West Boylston more than the tightly packed RCD design. This would give residents a more spacious feel and may attract more interest. Furthermore, the joined driveway and connected houses would improve the constructability of the homes because it is easier to build one duplex than two separate houses. Techniques like joining utilities and sewage within each duplex would reduce the amount of work and materials needed in construction.

The zoning of the 120 Prescott Street parcel was the only complication for the duplex site design. According to the West Boylston Zoning Map(T. o. W. Boylston, 2008), the property was zoned for single family residence. According to the RCD Zoning Bylaw, multifamily housing can only be placed within an area that is zoned for multifamily housing (West Boylston, 2010) However, in this case, the team had asked the board to consider a variance since RCD encourages low impact development satisfied by the duplex design.

4.2.2.4 Stormwater Analysis

The team conducted a comparison of the existing stormwater drainage and the design stormwater conditions for the RCD single family subdivision. This comparison would be similar for a duplex design, but would yield slightly different results due to the differing amount of impervious surfaces. The results of the analysis can be seen in Table 4 below. Overall, the total peak discharge increased from 8.36 cubic feet per second to 10.38 cubic feet per second from the existing conditions to the design conditions. The sites were divided into drainage areas as seen in the Figures 13 and 14. The additional runoff was accounted for by recommending stormwater management systems. In the RCD design, the final drainage areas can be compared to areas from the existing as listed on the chart; RCD one to existing three and seven and RCD two to existing four. The increases in proposed peak flows indicate the needed capacity for stormwater treatment.

Table 4: Results of stormwater peak discharge calculations.

Drainage Area	Time of Concentration	Runoff Coefficient	Rainfall Intensity (in./hr.)	Drainage Area (acres)	Peak Discharge (cfs)
	Tc (hrs)	C	i	A	Qp
Existing Conditions					
1	0.33	0.15	4.80	0.07	0.05
2	0.09	0.15	8.80	0.05	0.07
3	0.18	0.38	6.50	0.25	0.62
4	0.64	0.15	3.00	8.25	3.71
5	0.31	0.15	5.00	0.07	0.05
6	0.47	0.15	4.00	1.27	0.76
7	0.52	0.21	3.80	2.90	2.27
8	0.23	0.15	6.00	0.32	0.29
9	0.03	0.15	Negligible Amount	0.00	Negligible Amount
10	0.12	0.15	7.40	0.04	0.04
12	0.00	0.15	Negligible Amount	0.04	Negligible Amount
13	0.15	0.15	6.80	0.49	0.50
Total					8.36
RCD Single Family					
1 : 3+7 existing	0.74	0.19	3.30	5.12	3.21
2 : 4 existing	0.48	0.15	4.20	6.65	4.19
3	0.27	0.29	5.20	1.97	2.97
Total					10.38

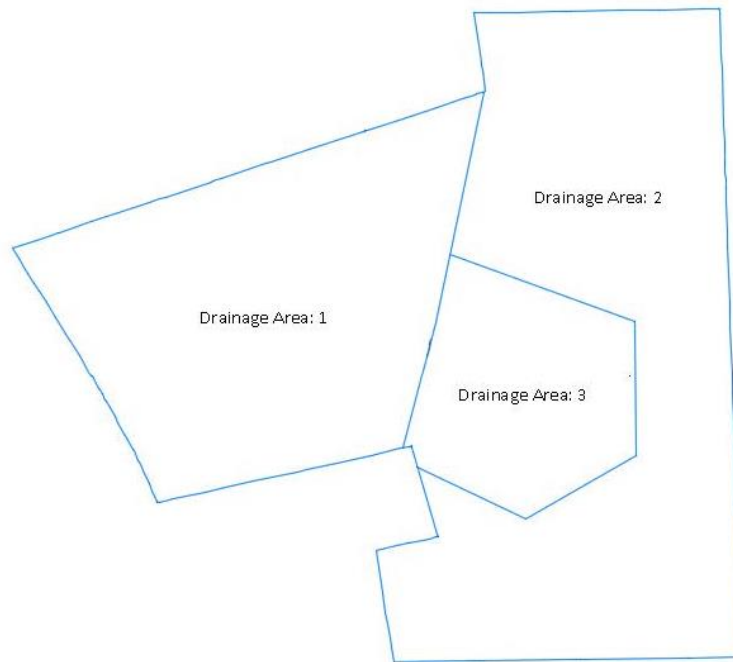


Figure 13: Watershed divisions for the RCD single family conditions. Numbering corresponds with Table 4.

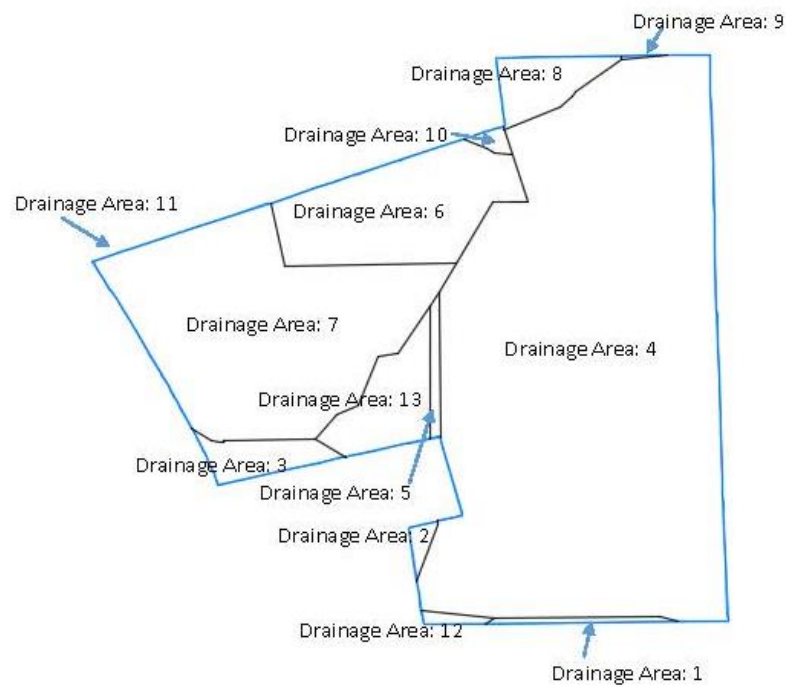


Figure 14: Drainage area divisions for the existing conditions. Numbering corresponds with Table 4.

4.3 Review with Local Agencies

The team simulated the formal process of submitting a preliminary plan to the West Boylston Planning Board in order to experience the whole process and get feedback on the designs. The team brought the following materials to the Planning Board for Review:

- Traditional Site Plan
- RCD Site Plan
- Duplex Site Plan
- Road Profile View
- List of Abutters (seen in Appendix E)
- RCD Promotional Material (seen in Appendix F)

Planning Board members gave the team feedback during the Planning Board meeting and as a follow-up. A few comments were made as to components missing from the team's plans. The team edited the site plans and promotional material according to the feedback. The Planning Board was excited about the promotional material and expressed interest in it in the future.

Overall, the Planning Board was pleased with the progress and breadth of the work completed along with the amount of effort put into the project. It noted that the site plans developed by the team were very helpful in comparing the different alternatives available to the town and highlighted the benefits of RCD well.

4.4 Cost Estimation

The team used Mass DOT 2014 cost data to estimate costs of paving the roads and earthwork for the traditional and RCD subdivision designs. The calculations for cost estimation can be seen in Tables 5 and 6. The team used areas, dimensions, and volumes from the AutoCAD Civil 3D designs to estimate all cost estimate amounts on the traditional and RCD designs. Tables 5 and 6 show the parameters that were considered during the cost estimation. There was a significant difference between the cost for a RCD and Traditional subdivision. The team found that with the RCD subdivision a developer could save over \$300,000 on this specific site. Although beyond the scope of this project, the team believes stormwater management and utilities would also result in lowering costs due to the more compact development of the site. Since the team's work was site specific and costs may differ at other sites, this savings was a major benefit to be considered and should encourage development of RCD in West Boylston.

Table 5: Earthwork and Pavement Cost Estimation for Traditional Site Plan

Item No.	Description	Units	Quantity	Price Each	Item Total
101.00	Clearing & Grubbing	AC	13.00	\$ 15,000.00	\$ 195,000.00
120.61	Earth Excavation	CY	4,550	\$ 20.00	\$ 91,000.00
151.00	Gravel Borrow	CY	2,000	\$ 35.00	\$ 70,000.00
697.00	Sediment Fence	LF	3,700	\$ 4.50	\$ 16,650.00
701.00	Cement Concrete Sidewalk	SY	725	\$ 40.00	\$ 29,000.00
402.00	Dense Grade Crushed Stone for Sub-base	CY	2,600	\$ 55.00	\$ 143,000.00
403.00	Reclaimed Pavement for Base Course	SY	5,200	\$ 6.25	\$ 32,500.00
456.00	Warm-Mix Asphalt Pavement	TON	290	\$ 2.50	\$ 725.00
				SUBTOTAL	\$ 372,650.00

Table 6: Earthwork and Pavement Cost Estimation for RCD Site Plan

Item No.	Description	Units	Quantity	Price Each	Item Total
101.00	Clearing & Grubbing	AC	3.00	\$ 15,000.00	\$ 45,000.00
120.61	Earth Excavation	CY	300	\$ 20.00	\$ 6,000.00
151.00	Gravel Borrow	CY	120	\$ 35.00	\$ 4,200.00
697.00	Sediment Fence	LF	3,700	\$ 4.50	\$ 16,650.00
701.00	Cement Concrete Sidewalk	SY	370	\$ 40.00	\$ 14,800.00
402.00	Dense Grade Crushed Stone for Sub-base	CY	1,500	\$ 55.00	\$ 82,500.00
403.00	Reclaimed Pavement for Base Course	SY	2,900	\$ 6.25	\$ 18,125.00
456.00	Warm-Mix Asphalt Pavement	TON	170	\$ 2.50	\$ 425.00
				SUBTOTAL	\$ 71,850.00

5 Recommendations

After conducting interviews and simulating the site design process, it was clear that RCD is a valuable technique and should be use much more frequently in West Boylston. The team did not define any substantial evidence which inhibits the use of RCD in West Boylston other than a general lack of awareness. However, the team has developed recommendations aimed to encourage RCD use. The recommendations are as follows:

1. Require an RCD preliminary plan for all subdivisions.
2. Raise awareness of RCD among developers and residents in West Boylston.
3. Create specifications for RCD multi-family housing.
4. If the Town were to develop the Mixter parcel, they use a duplex or multifamily RCD design.

5.1 Require an RCD Preliminary Plan for all Subdivisions.

The methodology of this project required the team to create an RCD site plan per the standard West Boylston subdivision and RCD bylaws. This process enabled the team to develop a traditional site plan for the property before developing the RCD plan. This gave the team an opportunity to compare the impact, cost, and flexibility of both designs. As previously discussed in the results and conclusions section, RCD proved to provide the most benefits in terms of impact, cost and flexibility. If all developers understood this comparison, RCD would be utilized much more frequently in West Boylston.

Currently, the West Boylston RCD bylaws require both a traditional and RCD preliminary plan. However, developers who wish to create a traditional subdivision do not need to prepare an RCD design. The team recommends that all subdivisions require a preliminary plan of an RCD

design on the property so that the designer or developer considers both options. This will also force developers to become more comfortable with the standards and practice of designing an RCD which makes it more likely for developers to attempt RCD in the future. Hopefully, this practice will allow developers to make a more appropriate decision on which type of design to use rather than going with the traditional method that they are already accustomed to.

5.2 Raise Awareness

The RCD bylaw in West Boylston was established in 2010. Given this, many developers and town residents may be unfamiliar with the theory and it may be misunderstood. Developers who have never designed or considered designing an RCD may not fully understand its potential impact. It was not until after the team completed the site design that they fully understood all of the benefits of RCD. An informational awareness tool may assist developers and residents in understanding the benefits of RCD which may be overlooked. The team designed an RCD awareness pamphlet to be used by the town to reach an audience of both developers and residents. The pamphlet, seen in Appendix F, describes what RCD is, why it is effective, the permit process, and compares RCD and Traditional subdivision specifications. Copies of the awareness pamphlet can be distributed at the town hall or viewed on the town website as a pdf.

5.3 RCD Specifications for Multifamily Housing

The team created a duplex RCD design with altered minimum lot sizes based on what they believed was feasible. There was a lack of clarity in the West Boylston bylaws for an RCD multifamily development. The West Boylston RCD bylaw does not specify a minimum lot size for multi-family housing, but states a general minimum lot size of 5,000 square feet. Moreover, if a designer were to follow traditional multi-family specifications, a multi-family home would require

20,000 square feet per dwelling unit. This size would be similar to a traditional subdivision minimum lot of 40,000 square feet. For the case of this project, the team assumed 5,000 square feet per dwelling unit in an RCD design, and as a result 10,000 square feet per duplex lot. The team recommends that the town of West Boylston defines a more realistic minimum lot size for an RCD multifamily subdivision to allow adequate space for a dwelling unit with the same amount of open space required. The team's duplex design resulted in an average lot size of approximately 14,000 square feet. Given that this was a very comfortable amount of space, the team recommends that the minimum lot size for a duplex RCD be set to at least 10,000 square feet. This may also suggest 5,000 square feet per dwelling unit to accommodate other multifamily homes as well.

5.4 Develop Multifamily Housing on the Mixer Parcel

The team recommends if the Town of West Boylston were to develop the Mixer parcel, that they create a multifamily RCD subdivision. Based on the Housing Production Plan and the team's discussions with Town employees and officials, the team believes multifamily housing best fits the current needs of West Boylston. Multifamily housing would allow the Town to consider renting properties to young professionals or the 55 and over population as stated in the Housing Production Plan. A multifamily RCD design would also yield similar cost benefits as stated in our cost comparison for single family RCD and traditional in Tables 5 and 6.

Appendix A: Proposal

RESIDENTIAL CLUSTER DEVELOPMENT IN WEST BOYLSTON, MA

A Major Qualifying Project Proposal

Submitted to the Faculty

of

WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

in Civil Engineering

by

Melissa Landi

Christopher Long

Briana Weisgerber

September 25, 2014

Abstract

The Town of West Boylston, MA has implemented residential cluster development (RCD) bylaws for the community. Developers in the town are not using these bylaws which are meant to diversify housing options and preserve open space. This project will investigate the reasons developers are not proposing RCDs and identify limitations in design options for RCDs under the current bylaws. The project will use interviews and a site design to develop recommendations and promotional materials for the town of West Boylston.

Capstone Design Statement

This Major Qualifying Project will consist of two preliminary subdivision designs for the Town of West Boylston. During this design process, the team will hold ourselves to certain design methods and standards established by the Town of West Boylston and the State of Massachusetts. The following constraints will be addressed during the completion of this project: economic, environmental, health and safety, social and constructability.

Economic: The local economy is a key player in the subdivision design process. To take this into consideration the team will consider needs of possible inhabitants. For example, recent college graduates (whom West Boylston is trying to attract) may not have the financial stability to purchase a house and therefore rental apartments may be considered. In addition we will compare the costs of developing traditional versus residential cluster developments.

Environmental Sustainability: Environmental sustainability will play a large part in the design. One of the purposes of residential cluster development is conserving open space. When creating both site plans the team will consider other environmental factors including low impact development and storm water management. In this project the team will also consult the Department of Conservation and Recreation to work around conservation land on the property. The Department of Conservation and Recreation is mandated to protect the water quality within the Wachusett Reservoir, which is the drinking water supply for 2.2 million people in Metropolitan Boston (Massachusetts, 2014b; West Boylston, 2013).

Constructability: To consider constructability, the team will assess the pre-existing infrastructure on the site. They will design the subdivision around existing infrastructure or account for the costs of additional infrastructure. The team will also consider the amount of grading and geographic features when designing the subdivision.

Ethical: In the subdivision the group will follow the West Boylston subdivision regulations and provide realistic recommendations for RCD. Throughout this project the team will aim to provide the best possible solutions for each party affected. The team will also follow ASCE code of ethics when conducting this project.

Health & Safety: The team will address the constraints of health and safety by complying with town regulations, which look out for the health and safety of the population. The team will also be creating a healthy environment to live in by allowing for the preservation of open space in a residential community.

Social Political: One social and political constraint on this project will be working with elected officials from planning board. This will help meet the needs of the West Boylston Housing Production Plan, Master Plan, and the social needs of the town through designing the RCD and making recommendations to help implement their intents.

Table of Contents

1.0 Introduction.....	1
2.0 Background	2
2.1 West Boylston	3
2.2 Department of Conservation and Recreation.....	6
2.1 Residential Cluster Development	6
2.1.1 Massachusetts.....	6
2.1.2 West Boylston.....	9
2.2 Site Plan Development	11
3.0 Methods.....	12
3.1 Challenges Restricting Use of RCD	13
3.1.1 Interview with Local Developers	13
3.1.2 West Boylston Site Plan Design	14
3.2 Methods to Attract RCD to West Boylston	16
3.2.1 Interview with Local Developers	16
3.3 Schedule	16
4.0 Appendices	Error! Bookmark not defined.
Appendix A: West Boylston Developer Interview	18
Appendix B: Holden Developer Interview	19
Work Cited	21

Table of Figures

Figure 1: Layout of project from goal through final deliverables.	2
Figure 2: The Town of West Boylston's zoning map. Error! Bookmark not defined.	
Figure 3: Massachusetts Smart Growth Toolkit visual comparison of conventional subdivision to open space residential development.	8
Figure 4: West Boylston map showing parcels surrounding the Mixer property (Parcel Number 30) (Citation).....	14
Figure 5: Team's schedule for duration of project.	17

1.0 Introduction

West Boylston, a rural town in central Massachusetts, is currently facing challenges encouraging developers to utilize residential cluster development (RCD). Residential cluster development, also known as open space development, is a form of subdivision development with smaller minimum lot acreage requirements than traditional subdivisions to allow for preservation of open space. Residential cluster development is one method to address the Town of West Boylston's 2005 Master Plan goals. These goals are centered around diversifying housing options in the town for different lifestyles and incomes and preserving natural open space ("Master Plan of the Town of West Boylston," 2005). This is old and will be updated to reflect the ideas in the Housing Production Plan (West Boylston, 2013). The planning board believes that RCD could help achieve these goals, however a developer has yet to propose an RCD in West Boylston.

The goal of this project is to review the bylaw and propose recommendations for the Town of West Boylston to help encourage residential cluster development in the community. To accomplish this goal the main objectives are as follows:

1. Identify challenges restricting the use of residential cluster development in West Boylston.
2. Identify methods to encourage the use of residential cluster development in West Boylston.

Specific methods have been identified for each objective, which include conducting interviews with local developers and designing a preliminary subdivision plan according to West Boylston Zoning Bylaw 3.11.E (see Figure 1 below). Through these processes the team will develop a site plan comparison and promotional materials to help the planning board and the Town of West Boylston encourage residential cluster development in the community.

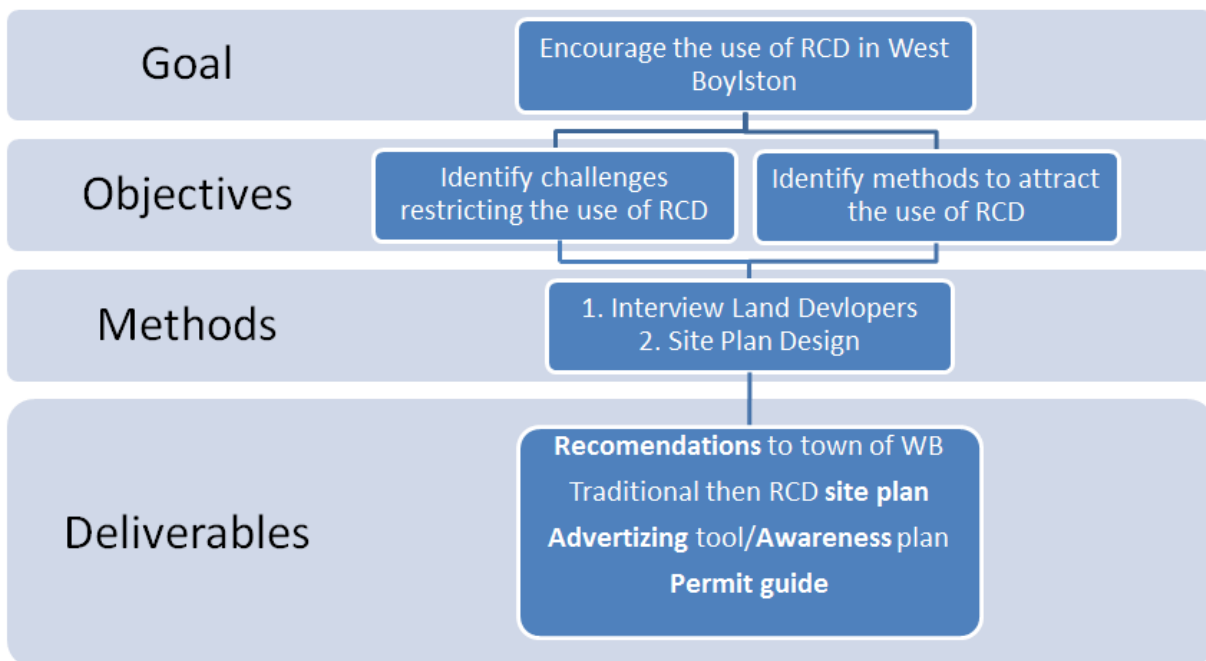


Figure 1: Layout of project from goal through final deliverables.

2.0 Background

The town of West Boylston faces challenges as it plans for its desired residential growth. The section contains examples of towns in Massachusetts similar to West Boylston with successful residential cluster development by-laws as well as residential cluster development recommendations from the state of Massachusetts. In addition, this

background addresses the process of site plan development, to assist the team in their methods.

2.1 West Boylston

West Boylston is a charming rural New England town in central Massachusetts. The current population of West Boylston is 7,669 with 1,138 of those residing in the Worcester County House of Corrections (T. o. W. Boylston, 2008; West Boylston, 2013). The majority of the town is zoned for single-family residences, as can be seen in Figure 2 (T. o. W. Boylston, 2008). The remaining space is zoned for business, commercial and industrial use. The Wachusett Reservoir and the tributary streams that are owned by the DCR provide ample open space, and the local Aquifer Protection Zoning District protects the town's drinking water wells.

The Town of West Boylston's Master Plan, adopted in 2005, is an in-depth look at the conditions in town 10 years ago and is in the process of being updated to clearly define its future goals. Although the town has begun updating the Master Plan, the Planning Board completed the Housing Production Plan (HPP) in 2013 and the suggestions and directions of the HPP will be incorporated into the Master Plan update. The 2005 Master Plan includes three points related to the housing challenges in West Boylston:

- "A variety of housing options that meet the incomes, needs and lifestyles of a diverse population" ("Master Plan of the Town of West Boylston," 2005).
- "A strong supply of housing that is affordable and addresses the needs of our grown children and civil servants who appreciate what our community has to offer and who wish to live here" ("Master Plan of the Town of West Boylston," 2005).

- “Preservation of plentiful open space in order to protect our natural resources, maintain scenic views, and offer residents the pleasure of enjoying an unspoiled environment.”

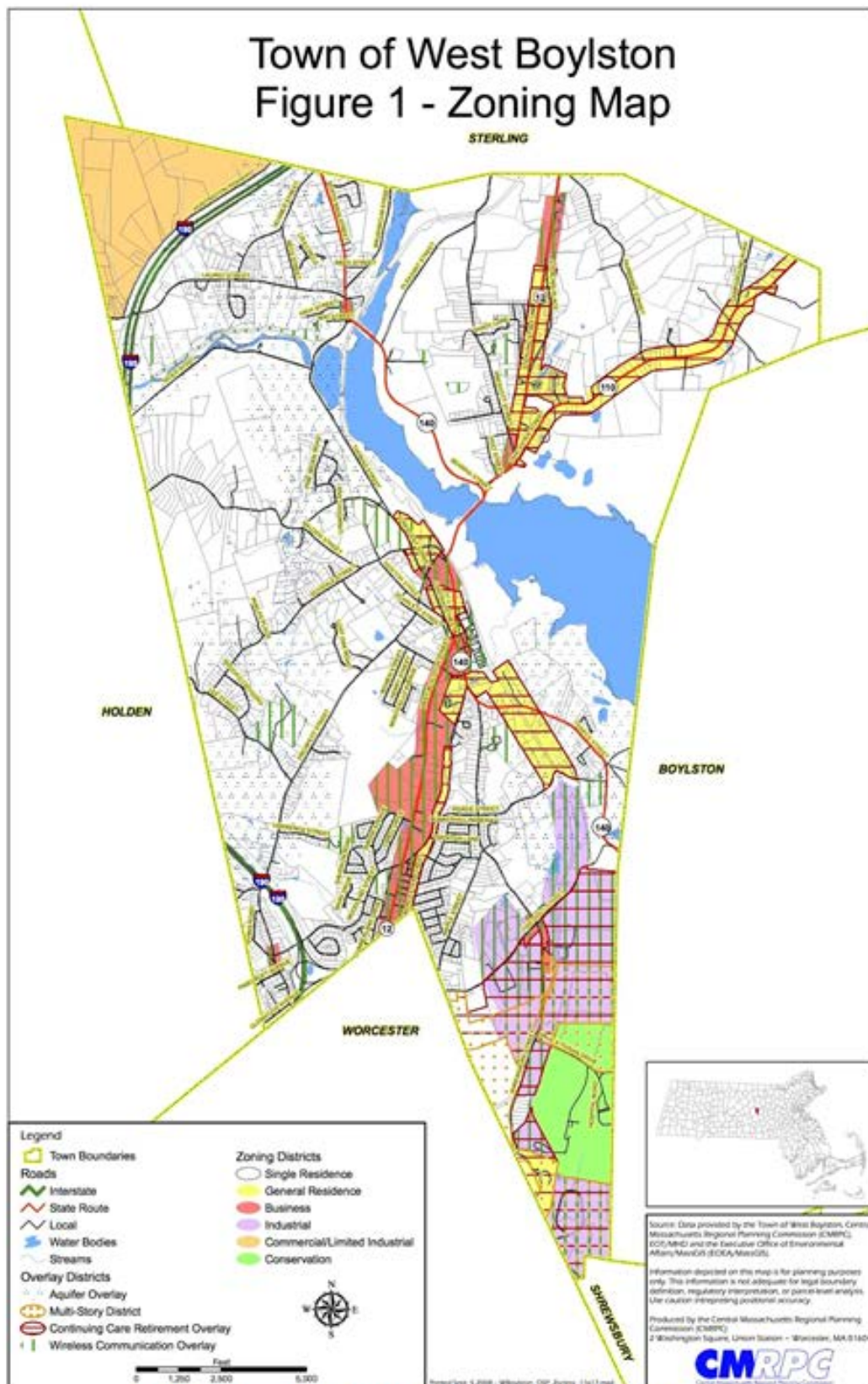


Figure 1: The Town of West Boylston's zoning map.

According to the 2013 Housing Production Plan, the town would like to encourage development of affordable housing for low income residents and diverse housing for young professionals and empty nesters. The town of West Boylston recently adopted a residential cluster development by-law that allows for clustered development of housing to leave open space for conservation. This bylaw could allow for more affordable homes to be constructed on small plots of land while still preserving open space. According to the Housing Production Plan, the planning board should consider this alternative whenever a preliminary subdivision is submitted (West Boylston, 2013). However, the by-law has yet to be attempted in the town of West Boylston (*Chapter 40B Land Area Minimum*).

2.2 Department of Conservation and Recreation

The Department of Conservation and Recreation (DCR) Division of Water Supply Protection is a Massachusetts state agency dedicated to protecting, managing, and enhancing the water quality within the Wachusett Reservoir (Massachusetts, 2014a). The reservoir was built from 1895-1905 to provide drinking water to Boston and the surrounding areas. To protect the sensitive areas of the watershed, the DCR purchases property in fee or buys development rights to property within the watershed (D. Massachusetts, 2012). DCR ownership restricts development on approximately 38% of the area of West Boylston (West Boylston, 2013).

2.1 Residential Cluster Development

2.1.1 Massachusetts

Open space development is also known as open space residential development or residential cluster development (RCD). An RCD is defined as subdivision development with

smaller minimum lot acreage and road frontage requirements than traditional subdivisions to allow for preservation of open space. This method is intended to protect existing agricultural land, wetland, or desirable landscape areas. It will create protected conservation areas and minimize impervious cover on the land while creating a development that equals the overall site density and fits the existing character of the town. An example of RCD can be seen in Figure 3, below. A traditional development may subdivide a parcel into eight one-acre lots. In contrast, an RCD might subdivide the parcel into eight-quarter acre lots and would leave six acres of communal open space. This method allows for conservation of protected land and requires less construction of infrastructure for the developer. The open space can be used as a buffer between the development and neighboring houses as well as land for trails, gardens, parks, and fields.

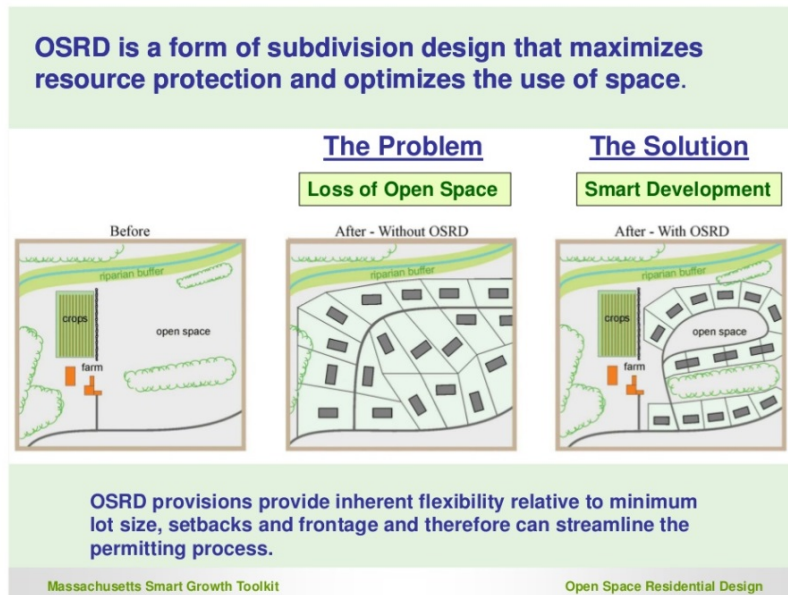


Figure 2: Massachusetts Smart Growth Toolkit visual comparison of conventional subdivision to open space residential development.

In Massachusetts the rate of land developed for residential and commercial use has surpassed the needs of the current population creating an excess of unused development (Gaertner, 2011). This development has created problems for communities across the state; including a lack of diversity in housing options, a threat to natural resources, and a loss of “community character”. One solution proposed by the Massachusetts Smart Growth Toolkit is to use open space development and natural resource protection zoning. These methods are encouraged to be used together, and allow for protection from many of the problems caused by residential sprawl.

In 2010, over 40 percent of Massachusetts municipalities had adopted some form of residential cluster zoning bylaws (Gaertner, 2011). As early as 1993, Assabett Estates was

developed on 32.6 acres of land in Westborough, Massachusetts as an “open space community development” (Belansky & Justus, 2000). Seventy-four percent of the parcel was reserved for open space and the roadway constructed was 30 percent less than if it had been a conventional development. The developer created a homeowner's association to manage the open space. He claimed that creating an open space community did not significantly decrease his profits compared to construction of a conventional development, because the infrastructure savings were significant.

Another example of successful open space residential development is the Woodbury Ridge development in Bellingham, Massachusetts (Belansky & Justus, 2000). Developers placed houses on six of the 16 total acres, which allowed for 10 acres of open space. The development created a number of benefits for homeowners including walking trails and scenic views from their houses. These benefits increased the appeal of the houses in spite of small lot sizes. The town planning board accelerated the review process due to the use of open space which saved the developer engineering costs ("Open Space Design/Natural Resource Protection Zoning,").

2.1.2 West Boylston

The concept of RCD was presented to West Boylston, Massachusetts in 2010 (T. o. W. Boylston, 2010). Vincent Vignaly, a member of the West Boylston planning board, recalls that the idea had initially faced a large amount of criticism from the town in part due to a lack of understanding. Local citizens were quick to refuse the system because it did not seem consistent with the town's character, and many were under the impression that it would result in higher population densities. Mr. Vignaly explained RCD would not change the population density of the area, but instead, would use the living space more efficiently in

order to maintain more open space and provide buffers from existing abutters to the site. The town decided to implement a 50-foot setback from roads and perimeter property lines in order to maintain the rural and private character in the town. In spite of the initial apprehension at the October 18, 2010 Town Meeting, the bylaw was ultimately passed (Vignaly, 2014).

Residential cluster development is a feasible solution to many of the housing challenges faced in West Boylston. High population density developments, such as developments under Massachusetts General Laws, Chapter 40B, often stress the existing water, sewer, parking, and transportation systems. Projects under 40B may request reductions from the West Boylston Zoning Bylaws minimum standards if 20-25% of the development is designated to be subsidized housing as defined by the Massachusetts Executive Office of Housing and Economic Development (*Chapter 40B Land Area Minimum*). The developer may appeal to the State Housing office, which often results in their approval of significantly higher densities than generally allowed under local zoning, which may not be compatible with the existing character of a neighborhood and will likely require additional costs for the town and developer to improve the infrastructure.

The HPP notes that West Boylston housing is predominantly suitable for families. The town intends to use RCDs to create affordable rental housing to accommodate different ages of residents (West Boylston, 2013). Rental housing aligns with the town's HPP and Master Plan goal number 11; "A variety of housing options that meet the incomes, needs and lifestyles of a diverse population" ("Master Plan of the Town of West Boylston," 2005). This housing may satisfy the needs of younger tenants as well as provide an option for older residents who intend to stay in the area but can no longer maintain a family-sized home.

The Department of Conservation and Recreation (DCR) creates significant open spaces within West Boylston when it buys property in fee or when it purchases development rights for land. When the land is purchased in fee, the DCR pays a PILOT fee (payment in lieu of taxes) to the town. PILOT payments are paid annually, similar to taxes, to the town (Massachusetts) (S. o. Massachusetts; Watershed). In Fiscal Year 2014, the town of West Boylston was paid \$642,130 in PILOT payments (Massachusetts, 2014c). When the DCR purchases the development rights to land, at about 80% of the full value of the land, there are certain restrictions made to prohibit building and development on the land. If the development is adjacent to DCR-controlled property, the buffers may be reduced and the benefits of more extensive open space are gained by the homeowners. The use of the RCD helps the DCR by protecting the land in environmentally sensitive areas. There are many clear benefits to RCD in West Boylston, however the feasibility is not clear. A strategic plan is needed to coordinate the Planning Board, Affordable Housing Trust and Building Department to capitalize on the density, monetary, and environmental benefits of RCD for the town.

2.2 RCD Plan Development

The planning process for a subdivision in West Boylston requires the designer and developer to follow the Site Plan Review town bylaws and regulations. The bylaws outline the basic procedures of a Site Plan Review. In addition to the RCD bylaws, the town has local subdivision regulations that are more specific to the design process to protect the buyer and general public. The process ensures the buyer that the land is suitable for its intended use, that the infrastructure is adequate, and that the public safety, health, and welfare is protected (Anderson, 2000).

The first step in the site plan design process is to file a Preliminary Site Plan and necessary waivers and fees to the Planning Board at a scheduled meeting. The designer must also submit copies of plans and a written notice of filing a preliminary plan to the Town Clerk(W. Boylston, 2002). The purpose of the preliminary site plan is to anticipate the capacity for development on the property as well as bring attention to any areas of concern in the design or on the site. Moreover, the designer will receive feedback from the Planning Board to help address potential problems to resolve them before the designer submits final plans or begins construction (Anderson, 2000).

After filing the Preliminary Site Plan, the designer may be required to submit a Definitive Site Plan. This document will take into consideration the critiques and concerns of the Planning Board and also include more detail than the Preliminary. The specific details that are needed are often specified by the town/state. Specific details for West Boylston site plans and procedures can be found on the town website under the Planning Board Rules and Regulations page. Depending on these specifications, the Definitive Site Plan will be reviewed by multiple agencies and brought up at a public hearing before it passes. When the document is approved, the required building permits may be issued. Disapproval of the site plan will require changes or additions to the plan and resubmittal at a later date(W. Boylston, 2007).

3.0 Methods

The goal of this project is to propose recommendations for the Town of West Boylston to help encourage residential cluster development in the community. To accomplish this goal the main objectives are as follows:

1. Identify challenges restricting the use of RCD in West Boylston.
2. Identify methods to attract the use of residential cluster development in West Boylston.

The team developed the following methodology to achieve these objectives, which will include interviews with local developers and two plan designs. The sections below outline the purposes and processes of each individual method in relation to the main objectives.

3.1 Challenges Restricting Use of RCD

To encourage RCD in West Boylston, the team will need to first understand the factors restricting the process currently. The group will conduct a two-step process:

- *Step one:* Interview current developers in West Boylston and surrounding towns
- *Step two:* Design of a preliminary subdivision plan in West Boylston, then design an RCD development plan and meet with the Planning Board to do a mock review??

The team plans to conduct interviews first to help better understand the subdivision process as a developer. Using the results, the team will then design a subdivision to explore the obstacles of the process first-hand.

3.1.1 Interview with Local Developers

By interviewing developers, the team plans to better understand reasons for not choosing to develop a residential cluster development in West Boylston and reasons for choosing RCD in similar towns. The team will first interview two developers who have worked recently in West Boylston. In these interviews, the team plans to discuss if the developers had considered RCD, why they had decided not to use it, and if they have

recommendations for possible ways to improve any existing obstacles (see Appendix A: West Boylston Developer Interview).

3.1.2 West Boylston Site Plan Design

The team will act as a developer to help understand the challenges with RCD in West Boylston. They will create two preliminary plans of the Mixer parcel (Figure 4 below) in West Boylston as outlined by the town of West Boylston's Planning Board regulations(W. Boylston, 2010).

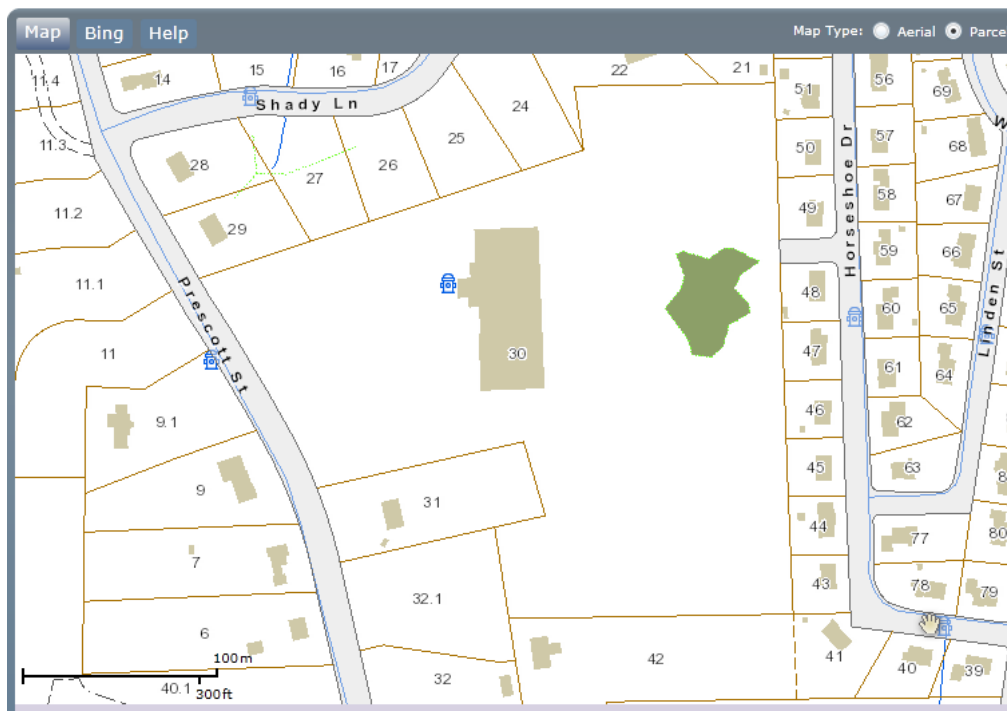


Figure 3: West Boylston map showing parcels surrounding the Mixer property (Parcel Number 30) (Citation).

The Preliminary Subdivision plan will involve a conventional subdivision of the parcel to determine the basic housing density potential at the site and the RCD plan will apply the design flexibility with the RCD zoning section to the parcel. The team will compare the two processes and designs to identify ways to improve the RCD bylaws and permitting process. The process of developing these plans will be completed as required under the West

Boylston Zoning and Subdivision regulations, and guided by insight from the developers as well as a step by step process found in the text of Planning the Built Environment by Larz T. Anderson (Larz T., 2000). The process of creating a Preliminary Site Plan is as follows:

1. Site Analysis – Examine characteristics of land and any visual or zoned conditions or limitations to consider during design
2. Identify Goals – Identify goals of the development and type (RCD or Conventional)(Multifamily or Single family)(Homeowner or Rental)
3. Review Local Zoning – Review the zone in which the parcel is located as well as local regulations.
4. Local Opinions – Consider ideas/suggestion from the West Boylston Planning Board, Affordable Housing Trust, and Building Department for the parcel and discuss limitations that may exist
5. Concept Plans – Experiment with multiple ideas and chose the best one or best parts of each (RCD/Traditional)
6. Preliminary Subdivision Plan – Design on a map which includes streets, grading, lots, number of dwelling units, and other attributes depending on town
7. RCD Plan Draft – Design on a map which includes streets, grading, lots, number of dwelling units, and other attributes depending on town
8. Cost Estimates – Assess costs of the development and construction
9. Review With Local Agencies – Review with a representative of the West Boylston Planning Board (Vincent Vignaly) to gain feedback
10. If changes need to be made, go back to step 3 and make the needed revisions
11. Present to Planning Board for comments/suggestions and incorporate those as applicable.

3.2 Methods to Attract RCD to West Boylston

To understand methods to attract RCD to West Boylston, the team will investigate what methods have worked in similar communities. More specifically, the team will investigate other communities' solutions to the challenges that are identified in section XX. The team will do this by interviewing developers who have created residential cluster developments in communities similar to West Boylston.

3.2.1 Interview with Local Developers

As introduced in section 3.1.1 the team plans to conduct interviews with two local developers who have created RCDs in Holden, Massachusetts: Winter Ridge Limited Partnership and Greenstone Realty, LLC. In these interviews the team will discuss obstacles and incentives of the established subdivision permitting process (see Appendix B: Holden Developers Interview). From these interviews the team will create promotional materials for RCD to be distributed to local developers.

3.3 Schedule

Figure 5 is the expected schedule over the course of two, seven week, terms. This plan breaks the project up into 3 phases; the proposal phase (1), methods phase (2), and final phase (3). The highlighted column represents the stage of the project at the time of submitting this proposal.

[illegible]

Appendix A: West Boylston Developer Interview

Interviewee: Developers who have worked in West Boylston

Possibly Including: Scott Gordon

Crescent Builders

Interviewer: WPI Students

Location: TBD

Introduction: Hello we are students from Worcester Polytechnic Institute and we are researching Residential Cluster Development in West Boylston. We would like to ask you a few questions regarding your experience with subdivision development. Responses will be kept anonymous unless permitted. Participation in our research is voluntary and you may end your participation at any time. You also need not answer every question in our interview.

Questions:

1. How long have you been doing site development as a career?
2. How many developments have you created in West Boylston?
 - a. How many of these developments were subdivisions?
3. For any of your subdivisions did you consider residential cluster development?
 - a. If yes: Why did you decide not to use RCD?
 - b. If no: Why did you not consider it?
4. Have you ever developed an RCD?
 - a. If yes: where?
5. Are there current restrictions in West Boylston's bylaws or regulations that make RCD less appealing to you?
6. Is there anything you recommend for the planning board to improve regulations, bylaws, or benefits that could make you consider RCD?

7. May we site your name as a source for this interview?

Appendix B: Residential Cluster Developer Interview

Interviewee: Developers Involved with Residential Cluster Development

Possibly including: Winter Ridge Limited Partnership

Greenstone Realty, LLC

Interviewer: WPI Students

Location: TBD

Introduction: Hello we are students from Worcester Polytechnic Institute and we are researching Residential Cluster Development in West Boylston. We would like to ask you a few questions regarding your experience with subdivision development. Responses will be kept anonymous unless permitted. Participation in our research is voluntary and you may end your participation at any time. You also need not answer every question in our interview.

Questions:

1. How long have you been doing site development as a career?
2. How many developments have you created in Holden?
3. How many of these developments were traditional subdivisions?
4. For these subdivisions, did you ever consider RCD?
 - a. Why or why not?
5. How many of your subdivisions were residential cluster development?
6. What made you decide to choose RCD?
7. Were there any specific incentives that encouraged the use of RCD?
8. Did you find RCD to be any easier than traditional subdivision?
9. Could you estimate the cost of savings of using RCD?

10. Have you ever considered developing in West Boylston?
11. Were there any restrictions you had to work around in the Holden regulations for residential cluster development?
12. May we site your name as a source for this interview?

Work Cited

- Anderson, L. T. (2000). *Planning the Built Environment*. Chicago, IL: American Planning Association.
- Belansky, E., & Justus, S. (2000). Open Space Residential Development Four Case Studies. Retrieved 9/10/2014, 2014, from <http://www.greenneighborhoods.org/casebook.pdf>
- Boylston, T. o. W. (2008). *Town of West Boylston Figure 1 Zoning*. Worcester, MA: CMRPC.
- Boylston, T. o. W. (2010). *Residential Cluster Development (RCD) Bylaw*. Town of West Boylston.
- Boylston, W. (2002). *3.6 Site Plan Review Town of West Boylston Zoning Bylaw*. Town of West Boylston Retrieved from http://www.westboylston.com/Pages/WBoylstonMA_Bylaws/zoning_sect_3.6.
- Boylston, W. (2007). *Rules and Regulations Governing the Subdivision of Land in West Boylston, MA*.
- Boylston, W. (2010). West Boylston's Online GIS Geographical Information System: CAI Technologies. . *Chapter 40B Land Area Minimum*. Retrieved from http://www.westboylston-ma.gov/Pages/WBoylstonMA_AHT/land.
- Gaertner, K. (2011). *Innovative Zoning: Land Conservation via Development - Open Space Residential Design & Related Tools*: American Planning Association.
- Larz T., A. (2000). *Planning the Built Environment*. Chicago, IL: American Planning Association.
- Massachusetts. *MDC/DWM Land Management Plan 2001-2010*. Wachusett Reservoir Watershed.
- Massachusetts. (2014a). *Energy and Environmental Affairs Energy*: Massachusetts.
- Massachusetts. (2014b). *Office of Watershed Management*.
- Massachusetts. (2014c). *Payment in Lieu of Taxes (PILOT) Program*. Massachusetts.
- Massachusetts, D. (2012). *Update on DCR Land Acquisition*.
- Massachusetts, S. o. *Ware River Watershed Land Management Plan 2003-2012*. Mass.Gov.
- Master Plan of the Town of West Boylston. (2005). Retrieved 9/5/2014, 2014, from http://www.westboylston.com/Pages/WBoylstonMA_TWPlan/master/index2
- Open Space Design/Natural Resource Protection Zoning. *Smart Growth/Smart Energy Toolkit*. 2014, from http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-osrd.html
- Vignaly, V. (2014, 09/08/2014).
- Watershed, W. R. *MDC/DWM Land Management Plan 2001-2010*.
- West Boylston. (2013). *West Boylston Housing Protection Plan 11/19/2013*. West Boylston,.

Appendix B: Interview Protocols and Results

David Eckhardt Site Walk

Interviewee: David Eckhardt (West Boylston Conservation Commission)

Interviewer: WPI Students

Location: Mixer Property

Introduction: Hello we are students from Worcester Polytechnic Institute and we are researching residential cluster development in West Boylston. We would like to ask you a few questions regarding your experience with subdivision development. Responses will be kept anonymous unless permitted. Participation in our research is voluntary and you may end your participation at any time. You also need not answer every question in our interview.

- If the property has a small amount of wetland, generally the requirement is to replicate 110% of the existing wetland if disturbed.
- Asbestos and PCP was removed from the Mixer municipal building site/
- Mass 4.5' below grade (water table)
- Developers on this property would be required to go to wetland scientist and file a notice of intent and in turn receive an order of conditions from the Conservation Commission.
- Team should contact EcoTec - Art Allen / John Rockwood for professional input on wetlands on the property.
- Stormwater management is approved by Planning Board, not Conservation Commission.
- Team should look into presenting for Massachusetts Assembly of Conservation Commissioners.
- For the building code, the dwellings must have sprinklers if multifamily units of three or more.
- Team should look into protecting intellectual property rights because there is much interest in our solution for the town.

Interview with Jeff Perkins

Interviewee: Jeff Perkins (Developer)

Interviewer: WPI Students

Location: Colonial Cooperative Bank

October 30, 2014 at 12:00 PM

Introduction: Hello we are students from Worcester Polytechnic Institute and we are researching residential cluster development in West Boylston. We would like to ask you a few questions regarding your experience with subdivision development. Responses will be kept anonymous unless permitted. Participation in our research is voluntary and you may end your participation at any time. You also need not answer every question in our interview.

- Olde Century Farm Road, Goodale Street in West Boylston
 - Ross Associates - Gary Prime, did the design
 - Site
 - Dealt with Chapter 61 - forestry in a ten year time frame
 - Wait for sewer to come up Goodale St.
 - Soil was sand - former gravel pit
 - Brook on part of the property - DCR restrictions
 - Septic didn't fit with land area and same number of lots
 - Owned part of property, bought others as they went up for sale
 - While waiting for permits, economy tanked
- West Boylston standards for road building are higher for private than municipal standards
 - Road work for sewer line destroyed roads
- West Boylston not known to be friendly towards developers
- DCR or Town first for development?
- Process
 - Engineer created conceptual design
 - Went to DCR first with conceptual and learned about restrictions and setbacks
 - Did not go to town, waited for sewer
 - Paid off lots
 - Not sure who next because lots of back and forth between ConCom and other boards
 - High price for design
- RCD

- Seriously would've considered it if it had existed because increased density could've allowed for easier sewer and road and less to deal with in conservation area
 - Wouldn't have had to wait for sewer - communal septic
- Cluster - might need better wording
- Forsberd in Bolton, MA development (RCD)
- Public - negative to change
 - Does not totally understand DCR PILOT
- Improvements
 - Group of Board representatives (Health, Conservation, DCR, Fire, etc.) at one meeting to discuss all challenges
 - Rutland, MA
 - Likes the idea of accelerated process too
- Member of Planning Board in Sterling, MA
 - less sensitivity than WB
- Mixer - thinks water table is high so good to use sewer

Interview with Developer from Over 55 Development

Introduction: Hello we are students from Worcester Polytechnic Institute and we are researching residential cluster development in West Boylston. We would like to ask you a few questions regarding your experience with subdivision development. Responses will be kept anonymous unless permitted. Participation in our research is voluntary and you may end your participation at any time. You also need not answer every question in our interview.

Interviewee: Developer from Over 55 Development

Interviewer: WPI Students

Location: WPI Telephone Interview

October 29, 2014 at 3:00 PM

- Angellbrook 55+ Development in WB
- Heritage Design Group - did WB project
- Have done RCD
- Benefits of RCD
 - Money, site location, zoning bylaws are compatible
 - Increased density leads to increased profit possible
 - Minimal personal benefits
- Towards Boston, there's a higher demand for more expensive houses
 - Increased profit
 - Central Mass only \$250-300,000 homes
 - Towns like Millbury encourage commercial development
- Angellbrook property is buy and sell houses
 - Process
 - Numbers for feasibility of property
 - Engineer designs site
 - Preliminary plan submitted to town
 - Town and public feedback
 - Pursue purchase of land for development
- WB is easy to work with because "low dollar" town so more cooperative
 - Build to town "motto" or goal

Interview with Leon Gaumond

Introduction: Hello we are students from Worcester Polytechnic Institute and we are researching residential cluster development in West Boylston. We would like to ask you a few questions regarding your experience with subdivision development. Responses will be kept anonymous unless permitted. Participation in our research is voluntary and you may end your participation at any time. You also need not answer every question in our interview.

Interviewee: Leon Gaumond (Town Administrator of West Boylston)

Interviewer: WPI Students

Location: West Boylston Town Hall, 140 Worcester St.

- Ball fields, Parks - Walking Trails
- Market-rate Housing \$ for town
- Land poor community
 - Big Community
- Senior Center - Church Bethlehem Bible
 - 12,000 Sq. Ft building
 - Community + Senior Center
- Leach Fields - Police Station
 - Committed
- Sense in using for residential housing
- recreational opportunity is lacking in area
- affordable or market-rate possible
- Maple St. Property - Senior/affordable
 - meeting on 10/15 to discuss more affordable housing on properties 25+ acres
 - Board of Selectmen agreeable
- Town goal - affordable senior housing
 - long list waiting
 - young and old populations
- Last ten years - Hillside and Angelbrook
 - Market Rate

Interview Data Summary

Interview Protocol Analysis

Jeff Perkins (Former Developer)
Over 55 Developer
Dave Eckhardt
Leon Gaumond

Other Towns

Forsberd in Bolton, MA
development (RCD)

Site Design

Mixer - thinks water
table is high so good to
use sewer

Other References

ECOTECH - Art Allen / John
Rockwood Professional Input
Wetland, preservation of water

Wetland

small amounts
of wetland-
replicate 110%

Group of Board
representatives (Health,
Conservation, DCR, Fire,
etc.) at one meeting to
discuss all challenges
(Rutland, MA)

Member of Planning Board
in Sterling, MA
less sensitivity than WB

Towards Boston, there's a
higher demand for more
expensive houses

Increased profit
Central Mass only \$250-
300,000 homes

Towns like Millbury
encourage commercial
development

small amounts of
wetland-replicate
110%

Have to go to wetland
scientist
notice of intent -> order rights
of conditions

Building code
Sprinklers of 3+plexes

Ballfields, Parks -
Walking Trails

recreational
opportunity is lacking
in area

Mass Ass. of ConCom
presentation

John Hadley - Building Inspector
protect intellectual property
notice of intent -> order rights
of conditions

Maple St. Property -
Senior/affordable meeting on
10/15 to discuss more affordable
housing on properties 25+
acres Board of Selectment
agreeable

Interview Protocol Analysis

Jeff Perkins (Former Developer)

Over 55 Developer

Dave Eckhardt

Leon Gaumond

Process

While waiting for permits, economy tanked

RCD

Seriously would've considered it if it had existed because increased density could've allowed for easier sewer and road and less to deal with in conservation area. Wouldn't have had to wait for sewer - communal septic

WB Development

Olde Century Farm Road, Goodale Street in West Boylston
Ross Associates - Gary Prime, did the design
Dealt with Chapter 61 - forestry in a ten year time frame
Wait for sewer to come up Goodale St.
Soil was sand - former gravel pit
Brook on part of the property - DCR restrictions
Septic didn't fit with land area and same number of lots
Owned part of property, bought others as they went up for sale
While waiting for permits, economy tanked
West Boylston standards for road building are higher for private than municipal standards
Road work for sewer line destroyed roads

Mixer Property

Mixer - thinks water table is high so good to use sewer

West Boylston standards for road building are higher for private than municipal standards

Cluster - might need better wording

DCR or Town first for development?

Forsberd in Bolton, MA development (RCD)

West Boylston not known to be friendly towards developers

Mass 4.5' below grade (water table)

Engineer created conceptual design. Went to DCR first with conceptual and learned about restrictions and setbacks. Did not go to town, waited for sewer. Paid off lots. Not sure who next because lots of back and forth between ConCom and other boards. High price for design.

Does not totally understand DCR PILOT

Group of Board representatives (Health, Conservation, DCR, Fire, etc.) at one meeting to discuss all challenges (Rutland, MA)
Likes the idea of accelerated process too

Have done RCD

Mixer - thinks water table is high so good to use sewer

Angellbrook property is buy and sell houses
Process
Numbers for feasibility of property
Engineer designs site
Preliminary plan submitted to town
Town and public feedback
Pursue purchase of land for development

Benefits of RCD
Money, site location, zoning bylaws are compatible
Increased density leads to increased profit possible
Minimal personal benefits
Leach Fields - Police Station
Committed

Angellbrook 55+ Development in WB. Heritage Design Group - did WB project

Angellbrook property is buy and sell houses
Process
Numbers for feasibility of property
Engineer designs site
Preliminary plan submitted to town
Town and public feedback
Pursue purchase of land for development

Sense in using for residential housing

WB is easy to work with because "low dollar" town so more cooperative
Build to town "motto" or goal

recreational opportunity is lacking in area
affordable or market-rate possible

Ballfields, Parks - Walking Trails

Land poor community
Big Community
Senior Center - Church Bethlehem
Bible 12,000 Sq Ft
building
Community + Senior Center

Sense in using for residential housing
recreational opportunity is lacking in area
affordable or market-rate possible
Town goal - affordable senior housing
long list waiting young and old populations
Last ten years - Hillside and Angellbrook
Market Rate
Public - negative to change

Appendix C: Stormwater Calculations

$$T_t = \frac{.007(nL)^8}{(P_2)^{5s^4}}$$

$n = .24$ for range from TR-55 Manual

L = varies per drainage area

$P_2 = .14 \frac{in}{hr} * 24 hr = 3.36 in.$ Mass Highway Manual

$s = .05$ average slope of property

Manning's Kinematic Solution						
Existing Conditions						
	n	L (ft)	P2 (in)	s (ft/ft)	Tt (hrs)	Tt (min)
1	0.24	250	3.36	0.05	0.33	20.09
2	0.24	50	3.36	0.05	0.09	5.54
3	0.24	114	3.36	0.05	0.18	10.72
4	0.24	566	3.36	0.05	0.64	38.63
5	0.24	226	3.36	0.05	0.31	18.53
6	0.24	383	3.36	0.05	0.47	28.26
7	0.24	436	3.36	0.05	0.52	31.35
8	0.24	154	3.36	0.05	0.23	13.64
9	0.24	13	3.36	0.05	0.03	1.89
10	0.24	72	3.36	0.05	0.12	7.42
11	0.24	0	3.36	0.05	0.00	0.00
12	0.24	88	3.36	0.05	0.15	8.71
13	0.24	213	3.36	0.05	0.29	17.68
RCD Conditions						
3+7 (front)	0.24	675	3.36	0.05	0.74	44.47
4 (back)	0.24	390	3.36	0.05	0.48	28.68
Cul-de- sac	0.24	190	3.36	0.05	0.27	16.13

Runoff Coefficient Calculations

	Paved C	% Paved	Unpaved C	% Unpaved	Final C
Watershed	0.85		0.15		
Existing Conditions					
3		0.33		0.67	0.38
5		0		1	0.15
6		0.08		0.92	0.21
7		0.25		0.75	0.33
13		0		1	0.15
RCD Conditions					
1 - 3+7 (front)		0.19		0.811	0.28
3 - Cul-de-sac		0.29		0.709	0.35

Appendix D: Daily Site Plan Development Log

10/28

- Paper
 - Reviewed Vinny's comments
 - Methodology structure plan
 - Established information to add to background
- Interviews
 - Failed at meeting Jeff Perkins
 - Contacted WB 55+ Developer
 - Interviewed
 - Left a message for Mike at Waterman Design - spoke with Paula
 - Emailed town administrator for senior center/55+ input
- Design
 - Attempted 2 ft. contours AutoCAD Civil 3D
 - Attempted LiDAR, but no license
 - Added points

10/29

- Meeting with LePage
 - Stormwater Design
 - Conservation Commission Follow up

10/30

- Interviewed Jeff Perkins
 - Recommendations for improvements to WB process
 - Steps he went through
 - Restrictions on his property
- Civil 3D
 - Created watersheds

10/31

- IDF Curve for Worcester used because it is closest to West Boylston
 - http://www.massdot.state.ma.us/portals/8/docs/designguide/ch_8.pdf
 - Pg. 8-25, 8-29
- Weighted runoff coefficients with estimations of areas of each surface type

11/3

- Right of Way in CAD
- Began Designing the location of Right of Way and considering the implications of different locations
- Attended the West Boylston Conservation Commission meeting

11/4

- Organization of methods section. Split up writing
- Figured out Parcel subdividing on Civil 3D
- Right of way in Civil 3D

11/5

- Met with LePage
 - Scheduled with Gaumond
 - Scheduled walk-through
 - Organized data analysis
- Design
 - Buffer into Civil 3D
 - Need traditional that is realistic (soccer field and wetland)

11/6

- Meetings
 - David Eckhardt (Conservation Commission) at parcel to discuss limitations of development
 - Leon Gaumond (Town Administrator) at Town Hall to discuss possible town plans for the parcel
- Emails
 - Thank you email to Mr. Gaumond
 - Thank you email to Mr. Eckhardt
 - Summary to Vinny
- Other
 - Read conservation bylaws
 - Problems with Civil 3D
 - Typed notes from meeting

11/10

- CAD
 - Calculate area needed for soccer field based on area currently used. Soccer field was moved.
 - Calculate area needed for parking for soccer field (can be found on the soccer field parking doc)
 - Created Wetland parcel
 - Found actual road requirements
- Writing
 - Methods: Interviews
 - Updated background to include HPP
- Contacted
 - A. Sylvia about Sewer
 - Called Ecotec

11/11

- CAD
 - Figured out problems with right of way
 - Set aside area for field and parking for traditional
- Writing
 - Completed changes to update Background section
 - Found unclear aspects of RCD process
 - Created Regulation Clarifications
 - Continued methods
 - Intro to the site design sections
 - Planning process

11/12

- Visited EcoTec Corresponded with wetland specialists.
- Continued writing methods for site plan design

11/13

- Completed Traditional site plan design (contours, buffers, recreation area, open space, roads, lots)
- 11 lots
- Began RCD conceptual designs

11/14

- Continued work on RCD design
- writing methods

11/17

- Changed radius of cul-de-sac
- Renamed and isolated areas on property
- labeling
- Continued Writing in methods section (Site analysis and site design sections)

11/19

- Met with Vinny
- recommended a duplex design to accommodate rental housing (per HPP goals)

11/20

- Analyzed Wetlands with Paul McManus

11/21

- Results & Analysis progress
- Methods
- Acknowledgements Page

12/1

- Completed break writing
- Edited Chris and Briana's writing

- Tried grading

12/2

- Intense design work begins. Sites need meet all regulations
- Developed third plan (duplex RCD design)
 - same principal benefits as a single family RCD design
 - More reasonable for rental housing and 55+ options
 - Satisfies HPP goals
 - Also creates more space between buildings
 - Single family RCD seems cramped with small lots and many houses
 - Duplex feels more spacious which may fit the rural character of the town better yet still satisfies the same basic density of dwelling units.

12/3

- Began attempting to grade property of traditional design
- Difficulty with program, trouble merging surface layers to develop an accurate final layer.
- Contours around roads difficult to develop correctly.

12/4

- Group realized that ROW needs to be 50 feet wide and was only currently 27 feet.
- Needed to redo ROW's.
- Changed grading, lot size, open space size, and parking lot boundaries, frontage
- After changing traditional ROW size, the Basic Density changed, only 10 dwelling units instead of 11.
- Eliminated one lot off of RCD which was closest to the parking lot, replaced with a proposed playground.
 - The placement of the playground allows parents to watch kids play soccer and siblings on the playground at the same time.
 - Playground also available to community with walking access from horseshoe drive.

12/5

- Grading on the RCD completed to place the high point in the middle of the road and low points both at the beginning of the road and at the end of the cul-de-sac.
- All setbacks defined and housing footprint layouts placed on the plan
- team had difficulty with labeling, new labels made, all consistent
- discussed the placement of runoff from fields in rain gardens
 - 30 foot vegetated buffers good place for rain gardens
 - possible to put rain garden in the center of the cul-de-sac

12/8

- Continued work on methods and results section of paper.
- Data from RS means acquired for cost estimation at the end of the project.
- struggled with grading of road to direct water to specific places in the cul-de-sac

12/9

- Finalizing and printing for review of LePage and Vinny before Planning Board meeting\
- Vinny unable to make meeting
- discussion of stormwater options
- All benefits of RCD clear to see in comparison with traditional
 - Low impact due to the lower impermeable surface area, less material costs, less grading costs, flexibility around troublesome areas (wetlands and slopes), and opportunities for 2 fields instead of 1 and a playground, enough parking spaces for safety.

12/10

- Review with Vinny before Planning Board meeting
 - gave advice on missing aspects of drawing
 - technical aspects of layers and lines
 - identified missing attributes
 - modified easement
 - modified labeling
 - needed legend
 - needed zoning table
 - Added all existing conditions
 - Added all abutters and property owners names
- Planning Board meeting at 7
- Team brought the preliminary plan to the Planning Board for review
 - Traditional plan
 - RCD Plan
 - RCD Duplex Plan
 - Road elevations/section
 - List of 100' abutters
 - photographs of current drainage
 - water flow analysis
 - Awareness pamphlet
- Planning Board was pleased with results and very happy to see all of the benefits of RCD. Also very interested in the awareness material.
- Board took the awareness plan mock up for review to be sent later.

12/11

- Writing results, conclusions, and recommendations
- Drainage design options.
- current capacities not known for drainage systems
 - this makes it difficult to design because the team does not know the threshold where there will be too much runoff
- Low impact development encouraged to minimize runoff needed to maintain

12/12

- Watershed analysis on RCD plan
- Comparison of peak flow between existing and RCD design conditions
- Watersheds difficult to define

- Writing results, conclusions, and recommendations

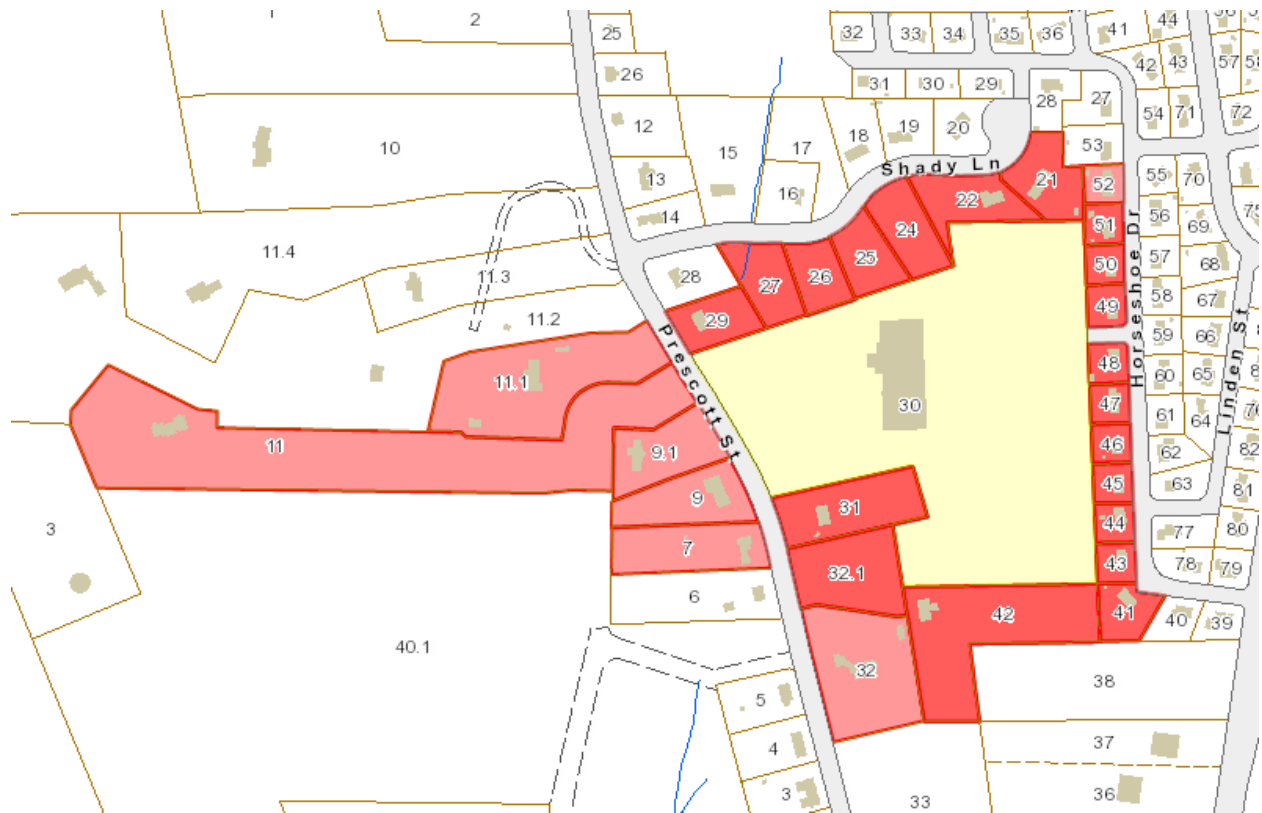
12/13

- Editing paper
- Compiling appendices

12/14

- Final revisions and edits to paper before First Submittal
- Edits made to promotional material per Planning Board review

Appendix E: List of Abutters





100' Abutters List Report

West Boylston, MA
December 10, 2014

Subject Property:

Parcel Number: 125/030/000
CAMA Number: 125/030/000
Property Address: 120 PRESCOTT STREET

Mailing Address: WEST BOYLSTON TOWN OF
127 HARTWELL STREET SUITE 100
WEST BOYLSTON, MA 01583

Abutters:

Parcel Number: 125/007/000
CAMA Number: 125/007/000
Property Address: 131 PRESCOTT STREET

Mailing Address: MEANOR FRANK A LIFE ESTATE
MEANOR DOROTHY P LIFE ESTATE
131 PRESCOTT STREET
WEST BOYLSTON, MA 01583

Parcel Number: 125/009/000
CAMA Number: 125/009/000
Property Address: 133 PRESCOTT STREET

Mailing Address: SCIRPOLI MATTHEW & FRONGILLO
HEATHER
133 PRESCOTT STREET
WEST BOYLSTON, MA 01583

Parcel Number: 125/009/001
CAMA Number: 125/009/001
Property Address: 135 PRESCOTT STREET

Mailing Address: OCONNOR TERRANCE G & JODIE A
135 PRESCOTT STREET
WEST BOYLSTON, MA 01583

Parcel Number: 125/011/000
CAMA Number: 125/011/000
Property Address: 139 PRESCOTT STREET

Mailing Address: DEAN DENNIS
139 PRESCOTT STREET
WEST BOYLSTON, MA 01583

Parcel Number: 125/011/001
CAMA Number: 125/011/001
Property Address: 141 PRESCOTT STREET

Mailing Address: TEAGUE ALYSON R TEAGUE MICHAEL
141 PRESCOTT STREET
WEST BOYLSTON, MA 01583

Parcel Number: 125/021/000
CAMA Number: 125/021/000
Property Address: 40 SHADY LANE

Mailing Address: SARKISIAN NORMAN R & MARILYN J
40 SHADY LANE
WEST BOYLSTON, MA 01583

Parcel Number: 125/022/000
CAMA Number: 125/022/000
Property Address: 36 SHADY LANE

Mailing Address: DIFEDERICO WILLIAM J DIFEDERICO
JUDITH D
36 SHADY LANE
WEST BOYLSTON, MA 01583

Parcel Number: 125/024/000
CAMA Number: 125/024/000
Property Address: 26 SHADY LANE

Mailing Address: LAUER SCOTT J & DARLENE
26 SHADY LANE
WEST BOYLSTON, MA 01583

Parcel Number: 125/025/000
CAMA Number: 125/025/000
Property Address: 26 SHADY LANE

Mailing Address: LAUER SCOTT J & DARLENE
26 SHADY LANE
WEST BOYLSTON, MA 01583

Parcel Number: 125/026/000
CAMA Number: 125/026/000
Property Address: 8 SHADY LANE

Mailing Address: LATORRE ERIK F & SARAH L
8 SHADY LANE
WEST BOYLSTON, MA 01583



www.cai-tech.com

12/10/2014

Data shown on this report is provided for planning and informational purposes only. The municipality and CAI Technologies are not responsible for any use for other purposes or misuse or misrepresentation of this report.

Page 1 of 3

Abutters List Report - West Boylston, MA



100' Abutters List Report

West Boylston, MA
December 10, 2014

Parcel Number:	125/027/000	Mailing Address:	LATORRE ERIK F & SARAH L
CAMA Number:	125/027/000		8 SHADY LANE
Property Address:	8 SHADY LANE		WEST BOYLSTON, MA 01583
Parcel Number:	125/029/000	Mailing Address:	MEOLA LISA M J
CAMA Number:	125/029/000		293 WEST BOYLSTON STREET
Property Address:	132 PRESCOTT STREET		WEST BOYLSTON, MA 01583
Parcel Number:	125/031/000	Mailing Address:	SMITH DENNIS SMITH DONNA MARIE
CAMA Number:	125/031/000		116 PRESCOTT STREET
Property Address:	116 PRESCOTT STREET		WEST BOYLSTON, MA 01583
Parcel Number:	125/032/000	Mailing Address:	PALADINO ARMAND F & MADELINE M
CAMA Number:	125/032/000		90 PRESCOTT STREET
Property Address:	90 PRESCOTT STREET		WEST BOYLSTON, MA 01583
Parcel Number:	125/032/001	Mailing Address:	PALADINO ARMAND F & MADELINE M
CAMA Number:	125/032/001		90 PRESCOTT STREET
Property Address:	PRESCOTT STREET		WEST BOYLSTON, MA 01583
Parcel Number:	125/041/000	Mailing Address:	CAROLYN MORSE DEVRIES TRUST
CAMA Number:	125/041/000		ROBERT N & OPAL A MORSE TRUSTEE
Property Address:	11 HORSESHOE DRIVE		11 HORSESHOE DRIVE
			WEST BOYLSTON, MA 01583
Parcel Number:	125/042/000	Mailing Address:	ATTELLA EDWIN J & DIANE K
CAMA Number:	125/042/000		151 STERLING STREET
Property Address:	151 STERLING STREET		WEST BOYLSTON, MA 01583
Parcel Number:	125/043/000	Mailing Address:	NICKERSON CATHERINE I NICKERSON
CAMA Number:	125/043/000		CLIFTON C
Property Address:	15 HORSESHOE DRIVE		15 HORSESHOE DRIVE
			WEST BOYLSTON, MA 01583
Parcel Number:	125/044/000	Mailing Address:	SEREWICZ JANICE E, f/k/a JANICE F
CAMA Number:	125/044/000		CROUSE
Property Address:	17 HORSESHOE DRIVE		17 HORSESHOE DRIVE
			WEST BOYLSTON, MA 01583
Parcel Number:	125/045/000	Mailing Address:	VEDUCCIO MARK R VEDUCCIO JO-
CAMA Number:	125/045/000		ANNE M
Property Address:	21 HORSESHOE DRIVE		21 HORSESHOE DRIVE
			WEST BOYLSTON, MA 01583
Parcel Number:	125/046/000	Mailing Address:	MAYOTTE JUSTIN & KAREN
CAMA Number:	125/046/000		25 HORSESHOE DRIVE
Property Address:	25 HORSESHOE DRIVE		WEST BOYLSTON, MA 01583
Parcel Number:	125/047/000	Mailing Address:	LYNCH JAMES B LYNCH ANNETTE M
CAMA Number:	125/047/000		29 HORSESHOE DRIVE
Property Address:	29 HORSESHOE DRIVE		WEST BOYLSTON, MA 01583



www.cai-tech.com

12/10/2014

Data shown on this report is provided for planning and informational purposes only. The municipality and CAI Technologies are not responsible for any use for other purposes or misuse or misrepresentation of this report.

Page 2 of 3

Abutters List Report - West Boylston, MA



100' Abutters List Report

West Boylston, MA
December 10, 2014

Parcel Number:	125/048/000	Mailing Address:	LYNCH FAMILY 2007 IRREVOCBLE TRUST LYNCH JAMES M & RITA T
CAMA Number:	125/048/000		33 HORSESHOE DRIVE
Property Address:	33 HORSESHOE DRIVE		WEST BOYLSTON, MA 01583
Parcel Number:	125/049/000	Mailing Address:	SANTIMAW KELLY FRIEDRICH ROBIN
CAMA Number:	125/049/000		39 HORSESHOE DRIVE
Property Address:	39 HORSESHOE DRIVE		WEST BOYLSTON, MA 01583
Parcel Number:	125/050/000	Mailing Address:	HILTON DEREK R HILTON LISA M
CAMA Number:	125/050/000		43 HORSESHOE DRIVE
Property Address:	43 HORSESHOE DRIVE		WEST BOYLSTON, MA 01583
Parcel Number:	125/051/000	Mailing Address:	WEISKEL PETER K SHEEHAN
CAMA Number:	125/051/000		KATHLEEN M
Property Address:	49 HORSESHOE DRIVE		49 HORSESHOE DRIVE
			WEST BOYLSTON, MA 01583
Parcel Number:	125/052/000	Mailing Address:	BLAKE STEVEN T BLAKE CAROL E
CAMA Number:	125/052/000		53 HORSESHOE DRIVE
Property Address:	53 HORSESHOE DRIVE		WEST BOYLSTON, MA 01583



www.cai-tech.com

12/10/2014

Data shown on this report is provided for planning and informational purposes only. The municipality and CAI Technologies are not responsible for any use for other purposes or misuse or misrepresentation of this report.

Page 3 of 3

Abutters List Report - West Boylston, MA

Appendix F: Awareness Tool

Use Options for Open Space

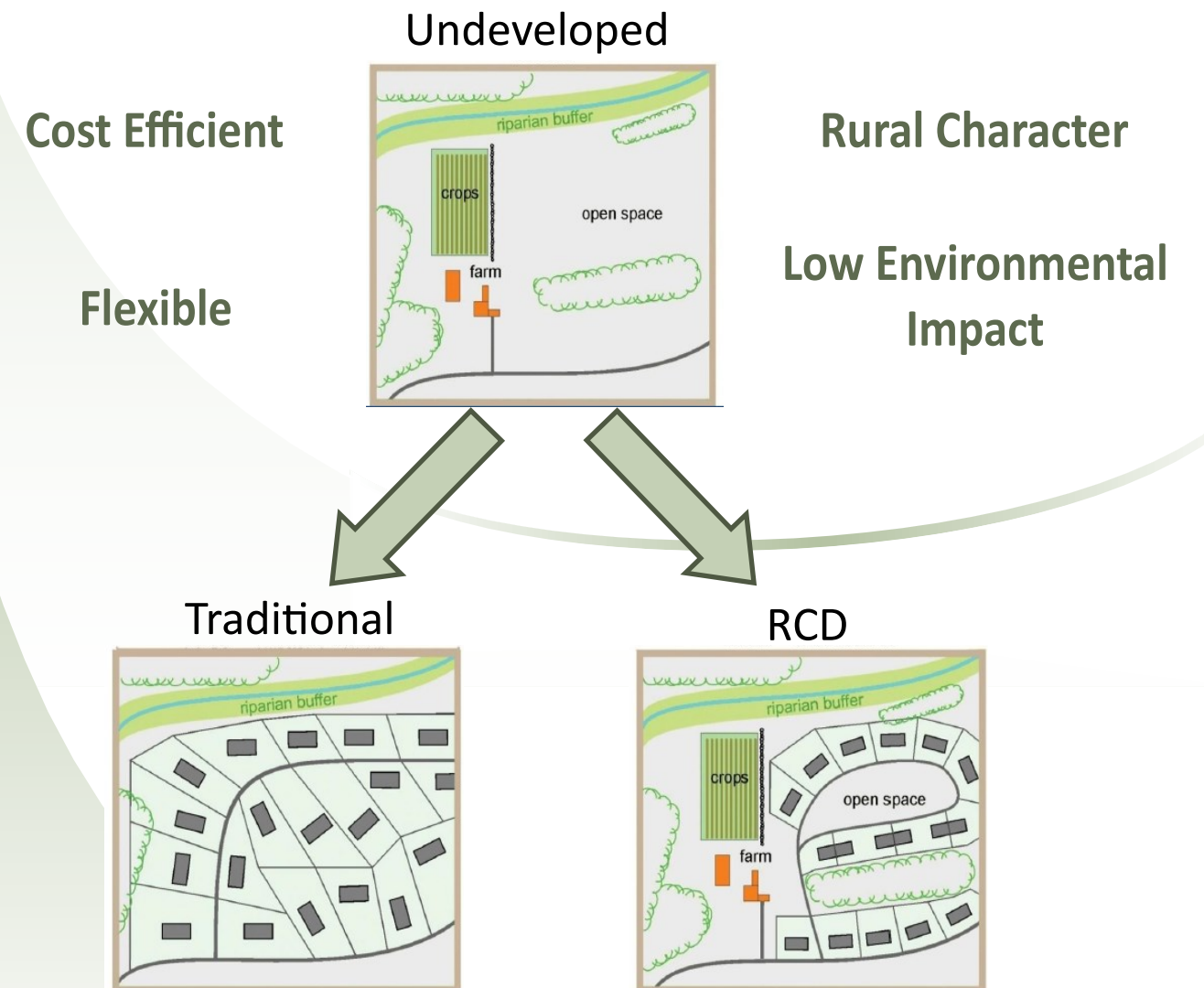
- BASEBALL FIELD
- SOCCER FIELD
- PLAYGROUND
- HOCKEY RINK
- HIKING/WALKING PATH
- BIKE TRAIL
- PARK
- PICNIC AREA / BENCHES
- COMMUNITY GARDEN

West Boylston Planning Board
140 Worcester Street
West Boylston, MA 01583
Phone: 774-261-4073

Email: planningboard@westboylston-ma.gov

Residential Cluster Development (RCD) West Boylston Zoning

RCD IS A LOW IMPACT DEVELOPMENT CONCEPT WHICH YIELDS DESIRABLE HOUSING AND MAINTAINS OPEN SPACE FOR PRIVACY AND COMMUNITY USE.



http://www.mass.gov/envir/smart_growth_toolkit/slideshows/introduction-to-osd-nrpz-slide-show.pdf

Benefits the Town and Developers

REDUCED ENVIRONMENTAL IMPACT

- Contaminated runoff reduced— Less impermeable surfaces
- Less land disrupted by grading and construction
- Lowers sediment runoff because of smaller construction area
- Flexible around sensitive areas such as wetlands and streams (avoids construction in these areas)

IMPROVED EASE OF CONSTRUCTION

- Less grading (earth movement) needed
- Flexibility allows for avoiding areas of difficult/expensive constructability (poor soils/rock/ledge/vegetation/slopes/wetlands)

RECREATION

- Creates spaces for town recreational facilities
- Open space for passive uses
- Playing fields / playgrounds
- Walking path access
- Trails in wooded areas

COST EFFICIENCY

- Lowers volume of materials
- Lower grading volumes
- Shorter Utility Lengths

POPULATION DIVERSITY

- Lower income viable
- Small yard (low maintenance)
- Accommodates 55+
- Accommodates recent college graduates



http://town.middleton.wi.us/index.asp?SEC=CA102B3D-5C8E-4FEC-8A29-0C90F2908CC0&DE=F64D3103-0799-45AD-A2FB-3774EFF32515&Type=B_LOC

RCD Process

Pre-Application Meeting

General Guidance / Brain Storm Options

Planning Board RCD Application Package

1. Conventional Design to Determine Basic Density
2. RCD Subdivision Design

Planning Board Review

Public Hearing (Comments, Concerns, and Professional Engineer Review)

Planning Board Decision

Conditions to Meet Standards

Flexible Standards / Abutters Protection

STANDARD	RCD	TRADITIONAL
Minimum Protected Open Space	40% of Tract Area	None
Vegetated Buffer	30 FT Wide 8 FT High	None
Subdivided Lot Frontage	50 FT	120 FT
Building Setback From Tract Perimeter	50 FT	10 FT
Internal Lot Setback	10 FT All Sides	25 FT Front 10 FT side/rear
Minimum Lot Size	5,000 SQ FT	40,000 SQ FT
Maximum Lots/Dwelling Units	Basic Density	Basic Density
Minimum Tract Size	5 Acres	N/A

Works Cited

- Anderson, L. T. (2000). *Planning the Built Environment*. Chicago, IL: American Planning Association.
- Belansky, E., & Justus, S. (2000). Open Space Residential Development Four Case Studies. Retrieved 9/10/2014, 2014, from <http://www.greenneighborhoods.org/casebook.pdf>
- Boylston, T. o. W. (2008). *Town of West Boylston Figure 1 Zoning*. Worcester, MA: CMRPC.
- Boylston, T. o. W. (2010). *Residential Cluster Development (RCD) Bylaw*. Town of West Boylston.
- Boylston, W. (2007). *Rules and Regulations Governing the Subdivision of Land in West Boylston, MA*. . Chapter 40B Land Area Minimum. Retrieved from http://www.westboylston-ma.gov/Pages/WBoylstonMA_AHT/land.
- Gaertner, K. (2011). *Innovative Zoning: Land Conservation via Development - Open Space Residential Design & Related Tools*: American Planning Association.
- Hopewell, K. (2010). *Town Clerk Meeting Minutes Oct. 8, 2010*. West Boylston, Massachusetts: Town of West Boylston.
- Massachusetts. (2014a). *Energy and Environmental Affairs Energy*: Massachusetts.
- Massachusetts. (2014b). *Office of Watershed Management*.
- Massachusetts. (2014c). *Payment in Lieu of Taxes (PILOT) Program*. Massachusetts.
- Massachusetts, D. (2012). *Update on DCR Land Acquisition*.
- Master Plan of the Town of West Boylston. (2005). Retrieved 9/5/2014, 2014, from http://www.westboylston.com/Pages/WBoylstonMA_TWPlan/master/index2
- Nyman, D. (2002). *Hydrology Handbook for Conservation Commissioners*. Boston.
- Open Space Design/Natural Resource Protection Zoning. *Smart Growth/Smart Energy Toolkit*. 2014, from http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-osrd.html
- . *Project Development & Design Guide*. (2006). Retrieved from http://www.massdot.state.ma.us/Portals/8/docs/designGuide/CH_8_a.pdf.
- Recommended Goal Sizes. (2012). Retrieved 12/14/2014, from <http://www.usyouthsoccer.org/coaches/goalsizes/>
- . *Urban Hydrology for Small Watersheds TR-55*. (1986). Washington D.C.
- Vignaly, V. (2014, 09/08/2014).
- Web Soil Survey. (2013). Retrieved 12/14/2014, from <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>
- West Boylston. (2010). *Residential Cluster Development (RCD) Bylaw*. Town of West Boylston.
- West Boylston. (2013). *West Boylston Housing Protection Plan 11/19/2013*. West Boylston,.